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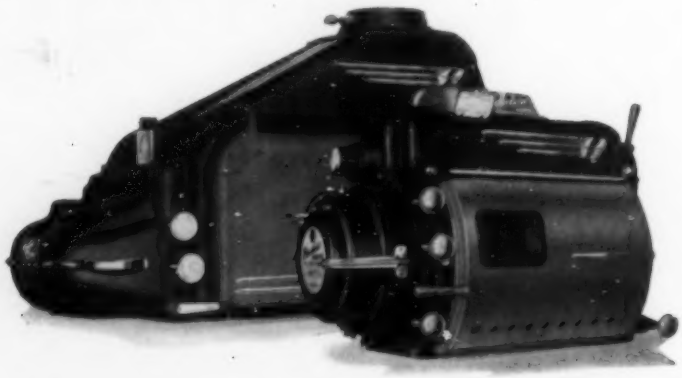

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INTERNATIONAL PROJECTIONIST

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Volume 30 NOVEMBER 1955 Number 11

Index and Monthly Chat 5

Rectifiers for Projection Arcs 7
ROBERT A. MITCHELL

Proposed Magnetic-Optical C'Scope Prints 10

55-mm CinemaScope Negative Will Improve Definition 12
ARTHUR GAVIN

Fast-Pulldown Intermittent Movements Solve Many Projection Problems 13
JOSE RUIZ

Cronar, New DuPont Film Base Soon to be in Production 16

Letters to the Editor 17

In the Spotlight 20

Growth of Closed-Circuit Tv is Aided By Portable Projectors 22
NORMAN WASSERMAN

All-Purpose Ace Splicer 23

Opinions Pro and Con About Todd-AO 24

Obituaries 25

Framing Index for Wide-Screen Pictures 26

Aluminum Plate Screen for Drive-Ins 26

Ray Brian — Motion Picture Historian, V 27

What Do You Know About Carbons? IV 28

News Notes — Technical Hints — Short Items

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Monthly Chat

"Good Equipment Seal" for Theatres

MOST PROJECTIONISTS are aware of that pronounced exhibitor tendency to stubbornly avoid replacing antiquated projection equipment before it falls apart. Because of the less-exacting projection requirements for the small pictures used in theatres a few years ago, exhibitors often got away with this short-sighted outlook even though the projectionist cursed while he held his rickety equipment together with baling wire. Since then, things have changed radically. The big screen absolutely requires modern projection equipment.

That's why we think that a plan recently worked out by a motion picture trade organization in West Germany has real merit and might be an effective tool in prodding some tight-fisted American theatre owners into improving their houses by replacing worn-out equipment. The German idea is to provide exhibitors with a free, unbiased, no-obligation survey of a theatre's projection equipment by independent experts. Theatres with equipment "technically unobjectionable" for the job of filling the theatre's screen with a pleasing picture would be awarded a "good equipment seal."

American projectionists, we think, would heartily approve of such a plan and assist it in every possible way. The results, we feel, would give the lie to the frequent accusations that the poor pictures in many theatres are due to careless projeotion.

To be successful here, this plan would probably have to be carried out under the direction of a committee composed of leaders in motion picture technical groups and exhibitor trade organizations. Such groups as the SMPTE and the MPRC might get together with exhibitor organizations. If assured that they would not have to cope with accusations of overselling equipment, manufacturers and their organizations would probably be happy to participate.

SMPTE Courses Point the Way

VERY WELCOME is the recent announcement by the SMPTE that it is sponsoring a course in motion picture technology in cooperation with the University of California and interested labor unions, evidently meaning the IA. At present, these courses can be taken only on the West Coast,and they are concerned with studio and laboratory practice rather than with the theatre, but they are still important news to projectionists because this educational program indicates that leaders in the industry now realize that the future of theatrical motion pictures depends on high technical standards.

A logical addition to these courses in film production technology would be a course for projectionists, perhaps held in a number of areas throughout the country, on the best methods of handling the complicated projection problems resulting from the new processes. Operating projection and sound equipment is no simple matter today in most theatres, and there is reason to believe that the situation may remain confusing as time passes. In addition, the introduction of wide-gauge film and elaborate "roadshow" methods of presentation make such a course doubly desirable.

The Projection Arc Lamps You Buy Should Have Automatic Crater Positioning!

Constant enlargement in screen sizes has necessitated a progressive ascent in the amount of light necessary to pleasing projection. To help in attaining this added brilliance a corresponding succession of increases in the burning rate of the positive carbon has been necessary. As compared to a burning rate of about 4 inches an hour in the old low intensity lamps, arcs today burn from 18 to 30 or more inches of positive an hour.

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VOLUME XXX NOVEMBER 1955 NUMBER 11

Rectifiers for Projection Arcs

There is a wide choice of equipment for converting AC to DC current as is required for projection arclamps. Here is a compact but thorough description of the many types of rectifiers available plus tips on maintenance.

By ROBERT A. MITCHELL

ANY ELECTRICAL DEVICE which conducts current *in only one direction* is called a "rectifier." If we apply alternating current (AC) to the input terminals of a rectifier, direct current (DC) will appear across the output terminals. Because this happens, we speak of a rectifier as a device which changes AC into DC.

Rectifiers have many useful applications. Certain types are used in electroplating and battery charging. Smaller rectifiers are incorporated into radios, phonographs, and other apparatus employing amplifiers operated on alternating current. As we might expect, the amplifiers of theatre sound systems involve rectifiers.

Rectifiers are used in many theatres as a source of DC for sound-head exciting lamps. The largest and most powerful rectifiers to be found in a motion-picture theatre, however, are those that supply direct current to the projector and spotlight arclamps. Many theatres, it should be stated, make use of motor-driven dynamos for arclamp service. Good as many rectifiers are, motor-generator sets are usually considered superior as regards constancy of performance and smoothness of the DC output. However, they are more expensive.

Now, motor-generators are current-converting devices which are *not* rectifiers. A motor-generator set, as its name implies, consists of a DC generator (dynamo) driven by an AC motor. AC is consumed by the motor: DC is *created*, or generated, by the dynamo. A rectifier merely rectifies, or "straightens out," the AC power which is fed into it.

A complete arclamp rectifier contains, among other components, one or more transformers, power-regulating controls, and voltmeters. Some types of rectifier also have motor-driven fans to maintain a low operating temperature. But the heart and soul of any rectifier is the part which changes AC into DC by allowing the current to flow in only one direction, blocking its flow in the other direction. The component which performs the actual job of rectifying may be an electron tube (valve) or a junction (couple) consisting of chemically treated metal disks pressed together in firm electrical contact.

FIGURE 1

In addition to the electrons emitted by the heated filament, a tungar rectifier tube contains atoms of argon gas. These, when bombarded by electrons, give out additional electrons which increase the flow of current. A single electron emitted from the filament results in several electrons hitting the plate.

Even though there are other types, the *tube-type* and *junction-type* ("stack") rectifiers are favored for the purpose of supplying DC current to projection arcs. And in each of these two groups we find several varieties.

Tube-type rectifiers work on the principle that current normally flows through an electron tube in just one direction, namely, from the heated *cathode* (negative element) to the relatively cool *anode* (positive element). The process is very simple, and so is the tube which performs it.

The *tungar* (argon gas-filled) type of rectifying (Fig. 1) tube contains

only these two "elements," cathode and anode. For this reason it is called a *diode*, the prefix *di-* meaning "two," and the suffix *-ode* referring to a tube-element.

Function of Cathode

The function of the cathode is that of an electron-emitter; and in order to emit vast numbers of electrons, the cathode must be heated to a fairly high temperature. The required heat is furnished by a filament very similar to that of an ordinary light bulb. In fact, the filament of the tungar rectifying tube also serves as the cathode.

What happens when the filment of a tungar bulb is heated by turning the current on? The tube sends out light just as an incandescent lamp does. But even though invisible to the eye, multimillions of electrons boil out from a filament and form a cloud of negatively charged particles around it.

The same thing happens when an ordinary light bulb is switched on; but a tungar rectifying bulb also contains a small amount of argon, a rare gas, which assists the rectifying action and glows with a blueviolet light when "ionized" by electron bombardment. The blueviolet glow surrounding the filament reveals the location of the cloud of electrons and indicates that the tube is ready to rectify — which is what we want it to do.

Our diode, with filament lighted, is now in an operative condition. It is only necessary to connect the two elements of the tube in series with an alternating-current circuit — one wire to the cathode (filament) and the other wire to the anode (plate).

Fig. 2 shows the connections and the various components of the simple circuit *which is indicated by the heavy lines.* (Ignore the subsidiary filament circuit drawn with lighter lines.) The heavy-line portion of the transformer secondary represents a suitable source of AC; the resistor marked "load" represents a DC device such as an arclamp; and the white disk represents the diode rectifying tube with filament and plate.

Alternating Current Cycle

The terminals of a source of alternating current swing from positive to negative and back many times each second — 60 times a second in the case of commercial power in the United States. Now, when the terminal connected to the cathode is positive in polarity, the electrons hover close to the filament in a tight cloud because they are repelled by the negatively charged plate. As shown in Fig. 2, no electrons can then pass through the tube; and, as a result, no current flows in the circuit. It is just as though the tube were then an open switch.

A small fraction of a second later the polarity changes, and the terminal connected to the cathode (filament) becomes negative. As shown in "B" of Fig. 2, electrons at once stream from the cathode to the anode (plate), which, being then positively charged, attracts them strongly. The stream of electrons constitutes a flow of current; and the tube then functions as a closed switch.

This action is repeated over and over (60 times a second in the U.S.A., 50 times a second in Europe), the current aways flowing *in one direction.* But note that the positive and negative polarity signs *in Fig. 2 only* signify the polarities of cathode and anode *in relation to each other.* Considered as external terminals of a DC source these symbols must be reversed, *as we have done in all subsequent diagrams.* Confusion can be avoided by remembering that current always flows from negative to positive.

The simple rectifier circuit shown in Fig. 2 employs one diode which passes only *half of each complete cycle* of the AC applied to it, the circuit being "dead" during the alternate half cycles when the flow of current is blocked. So it goes without saying that if perfectly smooth, continuously flowing DC is desired, our "half-wave rectifier" is useless. Electroplating and battery-charging are applications which tolerate a strong "ripple" in the current, but projection arcs and sound amplifiers need DC which is free from ripple.

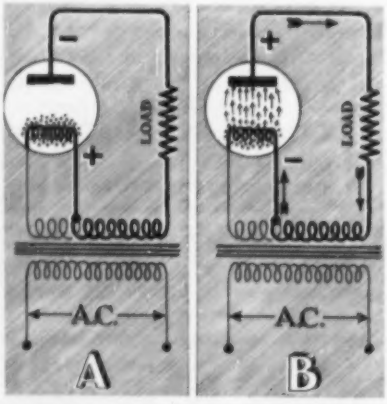


FIG. 2 (A). Electrons cannot pass from the heated filament (cathode) of a rectifier bulb when alternations of the current place a positive charge on the filament and a negative charge on the plate (anode). The electrons, being repelled by the plate, merely cluster about the filament as a space charge. (B). But when the current reverses, the electrons stream across the gap to the plate which, then positively charged, attracts them.

Electrical Filter Units

It happens, however, that the DC output of half-wave rectifiers pulsates too strongly to be smoothed out by any except large and very expensive electrical filter units. To improve the action of our rectifier, therefore, we must add another diode to permit the "dead" halves of the alternations to be rectified and added to the DC output.

The portion of Fig. 3 labelled "A" is a simplified diagram of the same half-wave tube rectifier shown in Fig. 2. For the sake of clarity the subsidiary filament-heating circuit has been omitted. Note the very strong ripple in the graph indicating the DC output of this rectifier.

"B" of Fig. 3 is the same rectifier, but with another diode added to give full-wave rectification. The transformer winding is tapped at its electrical center to provide a positive output terminal. One diode rectifies (passes current) during one half cycle, the other diode rectifies during the succeeding half cycle, and so on, the outputs of both tubes going to the negative output terminal. As the accompanying graph shows, ripple, although still present, has been reduced.

"C" of Fig. 3 shows a full-wave rectifier circuit employing 4 diodes. This hookup, called a bridge circuit, is capable of delivering more power than the 2-tube circuit in "B," although ripple content in the output is the same. This circuit is commonly used in small projection-lamp rectifiers operated on single-phase AC.

The comparatively small amount of ripple in the DC delivered by the full-wave circuits in "B" and "C" can be removed by filter circuits, such as the one shown in Fig. 4. A filter is very often thought of as a device which passes DC while blocking AC, but it actually does much more than that. The *inductance* of the choke coil in series with the circuit, and the *capaci-*

tance of the condenser connected in shunt, work together to chop off the crests of the waves and to fill in the troughs, changing the pulsating DC to smooth, continuous DC suitable for powering apparatus designed to operate on batteries or a dynamo.

The "single-section" filter circuit shown in Fig. 4 must have a very large choke coil and condenser to smooth out the ripple in the output of even a full-wave rectifier operated on single-phase 60-cycle AC. To obtain similar results more economically, several filter sections may be connected together.

Choke-Coil Filter

Very few arc-lamp rectifiers have more than a choke coil for filtering the DC because large condensers are costly and sensitive to high-voltage surges. The output current from a single-phase arc rectifier, accordingly, has some ripple. Light from the arc-lamp fluctuates slightly in step with the ripple of the DC at a rate of 120 times per second when the rectifier is supplied by 60-cycle alternating current.

Even though the flicker is too rapid to be perceived by the eye, the rotating shutter of the projecter interacts with the fluctuations of light to produce beat frequencies which can result in visible flicker. In the case of the 48-cycle shutter cutoff frequency employed in standard soundfilm projection, the beat frequencies are 72, 24, and 12 cycles when 60-cycle current is used, the 12-cycle beat usually being the strongest. When 50-cycle current is used, as in most European countries, the beat frequencies are 52, 4, and 2 cycles, the last ordinarily being the strongest. It is interesting to realize that the 2-cycle beat from 50-cycle rectified current is sufficiently slow to be much less conspicuous than the 12-cycle beat from 60-cycle rectified current.

Most projection-arc rectifiers, however, are supplied by 3-phase, rather than single-phase, 60-cycle AC. Now, 3-phase AC is equivalent to three separate, but interdependent, sources of AC; and a rectifier designed to operate on 3-phase current must have at least 6 diode bulbs for full-wave rectification, as shown in Fig. 5.

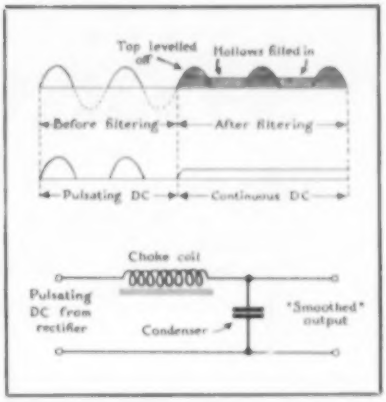


FIG. 4. "Sing'e-section" filter circuit having a choke coil (inductance) and a condenser (capacitance) to "smooth" the pulsating DC output of a rectifier into continuous (non-pulsating) DC.

Three-Phase Advantage

The advantage of 3-phase current for arc rectifiers lies in the equal angular displacement of the separate phases: the rectified current has only a slight ripple, and the pulsations are so rapid (360 per second in the case of a full-wave rectifier supplied by 60-cycle 3-phase AC) that no filter circuits are needed. Beat frequencies in the projected light do not appear unless differences in the outputs of the 6 tubes exist—which, unfortunately, is sometimes the case.

Mercury-vapor rectifiers are similar to tungar rectifiers in principle, the chief difference being the substitution of mercury for argon gas in the bulbs to increase conductivity of the current (electrons), making it possible to rectify greater amperages with fewer bulb units.

From the operational point of view, mercury-vapor rectifiers must be turned on at least 3 minutes before the projector arcs are struck in order to insure complete vaporization of the mercury and to avoid flashover in the tubes. Tungar bulbs, on the contrary, are ready for use the moment the filaments light up—a matter of a couple of seconds.

Mercury-vapor diodes are often erratic in current delivery and are more sensitive to changes in line voltage than any other commonly used rectifying device. Tube life is also rather uncertain, some mercury tubes lasting

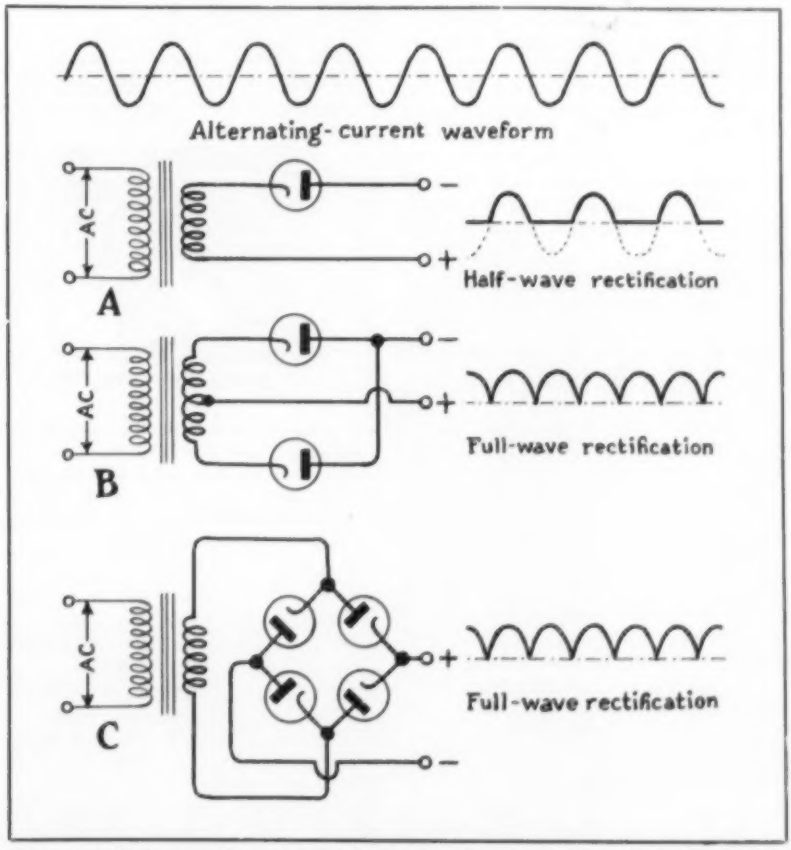


FIG. 3. Single-phase rectifier circuits with subsidiary filament circuits omitted for simplicity. (A). Half-wave rectifier. (B). Full-wave rectifier. (C). Bridge-circuit full-wave rectifier. Note relative amounts of "ripple" in the pulsating DC outputs of these circuits.

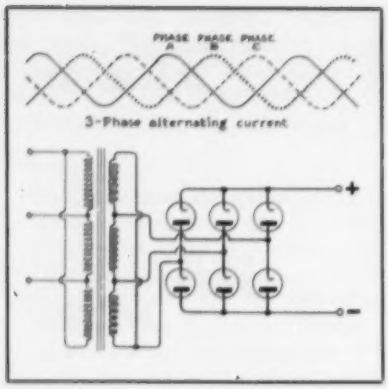


FIG. 5. Three-phase rectifier circuit with "delta" transformer-winding connections. The diode tubes shown in the diagram (tungar or mercury-vapor) may be replaced by junction units, as in a stack-type rectifier.

for months or years, and others suddenly failing to deliver full current. These rectifiers are sometimes noisy.

The circuitry involved in junction-type rectifiers (commonly called "stack" and "dry-disk" rectifiers) is basically the same as that previously given for tube-type rectifiers. There are no filament circuits, of course. In place of diode tubes, these rectifiers have stacks of specially treated metal disks. The several varieties are named after the material used on the surfaces of the disks for unidirectional current flow — copper oxide, copper sulfide, and selenium.

Danger from Heat

Junction-type rectifiers are efficient and very compact. They give out no light, but do generate considerable heat. Because the heat generated in the rectifying stacks can be very detrimental, fans are provided. To protect a rectifier of this type against injury in the event of fan failure, the main "on-off" switch is often a relay operated by a vaned switch actuated by the draft created by the fan. The projectionist, therefore, turns the rectifier on and off by means of the small fan switch.

The tungar-tube type of rectifier is preferred by many projectionists. It is quieter and less unpredictable in operation than the mercury-vapor type, and it is less expensive than the junction type. Copper oxide and sulfide junction-type rectifiers are long-lived under the most favorable conditions, but are quickly injured by temperatures in excess of the maximum rated operating temperature. In addition, selenium units are sensitive to the presence in the atmosphere of acid fumes, oxidizing agents, or metallic vapors.

Rectifiers for projection arcs are considerably lower in cost than motor-generator sets of the best quality, but often more expensive to maintain. With the exception of some of the older mercury-vapor rectifiers, they are quieter in operation than generators.

Rectifiers More Efficient

Rectifiers are electrically more efficient than motor-generator sets, wasting less current. Part of the reason for this may be found in the fact that multiple-arc generators require the use of current-consuming ballast rheostats, while the "falling-volt" characteristics of rectifiers eliminate the need for rheostats. But whereas one multiple-arc generator is sufficient to power several projection lamps, permitting two lamps to be burned at the same time during changeovers, there must be one separate rectifier for each lamp. (Trick switching arrangements intended to make possible the operation of two arcs from one rectifier are not approved.)

The performance of motor-generator sets is very reliable mechanically, and they are not affected by minor line-voltage variations. The output of a generator is also somewhat smoother than that of an ordinary arc rectifier, the slight commutator ripple being smaller than the ripple present in the output of even 3-phase and 6-phase rectifiers. In addition the output of a generator is also less adversely affected by temporary overloads.

Flicker on Screen

A disadvantage of rectifiers for projection service is the possible *inconstancy* of the DC output and consequent flicker of the projected light. Because a rectifier "straightens out"

(Continued on page 32)

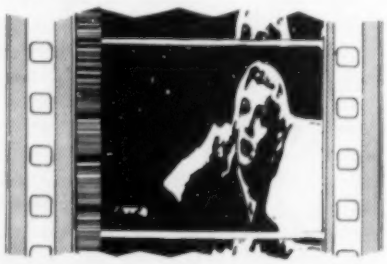
Proposed Magnetic-Optical CinemaScope Print

The Motion Picture Research Council, along with four major Hollywood studios, has proposed a combination of magnetic-and-optical sound tracks on each CinemaScope print to replace the separate magnetic and optical prints now made for all CinemaScope releases. The proposed dual-purpose print, with a single optical sound track running alongside the number 2 magnetic track, recently underwent a series of tests in New York City.

Earl Sponable, technical director of 20th Century-Fox where CinemaScope originated, has come out against this idea, stating that theatres now equipped for full stereophonic sound would be forced to cut the 2.55 CinemaScope aspect ratio to 2.35 or less, and that other theatres would be getting only "half a track" instead of a full optical sound track.

He advised all theatres to install magnetic heads, and to reproduce only the number 2 track of the CinemaScope magnetic print if single-channel sound was desired. The number 2 or center-horn track of the magnetic print will reproduce all sound recorded for a picture. To play this track, only a relatively small investment in equipment would be required. Needed would be a penthouse reproducer, magnetic preamplifier and CinemaScope sprockets.

The purpose of the proposed new magnetic-optical print is to avail distributors and exhibitors of a wider selection of marketable films. Distributors for a long time have objected to the high costs of magnetic prints and the limited market for them. Theatres on the other hand have complained that only a limited supply of magnetic or optical prints are available to them, depending on which type of installation they use. The dual-purpose single print is intended to increase the number of prints available for theatres using either the magnetic or optical systems.



The proposed combination magnetic-optical print would look like this. Note that the print contains the four magnetic sound tracks of CinemaScope stereophonic sound, with an additional optical track running alongside the No. 2 magnetic track.

"Mixer" kits offer an alternative solution to theatres not able to install full stereophonic sound. Now used in many drive-ins and being considered by indoor theatre owners as well, the mixer system channels all four CinemaScope magnetic tracks into one magnetic preamplifier. Provision can usually be made for conversion to a complete stereophonic system at a later date.

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55-mm CinemaScope Negative Will Improve Definition

Soon most 35-mm CinemaScope prints will be made from 55-mm negatives. Fox will also provide 55-mm prints for use by de-luxe houses. This article is reprinted through courtesy of the *International Cinematographer*.

By ARTHUR GAVIN

WHEN 20th Century-Fox took the $60,000,000 gamble on CinemaScope two years ago, it was with the promise to the industry that the studio would spare no expense in further improving the photography and exhibition of super-wide-screen CinemaScope motion pictures.

In recent weeks, another significant step has been taken by the studio, destined to further enhance the quality of CinemaScope productions. This was the development of the Fox 4X-55-mm camera. The "4X" symbolizes the four-times greater information-recording area of the 55-mm wide negative which is used in the camera.

The first Fox CinemaScope production, "The Robe," was started when the studio possessed but a single French-made anamorphic lens. This lens was subsequently improved by studio engineers and was known as an anamorphic "attachment" lens, because it was used in conjunction with the regular camera lens—mounted in front of it in the same manner that objective lens and anamorphic adapter are combined in the projection room.

Last year, Bausch & Lomb developed for the studio a combination CinemaScope lens in which the anamorphic and the objective lenses are combined in a single unit. This significant step greatly improved definition and depth of field and reduced distortion to a minimum.

New Anamorphic System

The 4X-55-mm camera was designed by 20th Century-Fox engineers and utilizes an entirely new type of anamorphic lens designed by the studio's New York research department and Bausch & Lomb engineers working in concert. With the new lens and the wider 55-mm negative, the studio claims it is possible now to achieve greatly improved wide-screen photography—much clearer and better defined pictures and a great deal less distortion on the screen.

Specifically, what is achieved by the new camera and 55-mm film is (1) a wider negative for use in making 55-mm release prints for roadshow type of theatre presentation, and (2) by optical reduction of the 55-mm negative, a much higher quality 35-mm CinemaScope print. Thus it would seem that the studio has taken a major step in fulfilling the promise it made with the advent of its venture into CinemaScope.

Special Lab Equipment

According to Sol Halprin, Fox executive director of photography, everything about the new 4X-55-mm system is new—camera, lenses, film, new printers, new travelling matte printers, and new developing equipment.

In the beginning, blank Eastman Color negative stock was slit in 55-mm widths, then perforated as required by a machine which the studio constructed especially for the purpose. Today of course, the negative stock properly perforated, is being supplied by Eastman Kodak.

The first 4X-55-mm camera was rebuilt on the lot by Fox engineers. Heading up the project were Sol Halprin, Earl Sponable, and Grover Laube. The present camera is equipped with 1,000-foot film magazines. Subsequent cameras, Halprin says, will have 2000-foot magazines and many innovations such as an improved pull-down mechanism, the ultimate in registration, and extreme fine contact at the aperture. The new cameras will be built for 20th Century-Fox by a prominent motion picture equipment manufacturer.

Shooting of "Carousel"

Following exhaustive tests at the studio, the prototype 4X-55-mm camera was assigned to Director of Photography Charles G. Clarke, A.S.C., for shooting the studio's initial 55-mm production, "Carousel." Shooting began on location in Maine, and the camera is exceeding all expections.

As one might expect the studio to properly do in putting a hitherto untried camera into production for the first time, the 4X-55-mm camera was backed up by a second standard 35-mm camera, also shooting in CinemaScope, as a protective measure.

It was not until after three weeks location shooting on "Carousel" at Boothbay Harbor, Maine, that studio executives saw any of the 55-mm camera results on the screen at the

(Continued on page 31)

Sol Halprin, Fox Camera Chief, examines the new 55-mm camera which will soon be used to shoot all CinemaScope films. Use of a 55-mm negative will make it possible to produce a sharper 35-mm 'Scope print for all theatres. No new equipment will be required for projection.

Present heavy demands on projection equipment point to the need for re-examining the heart of the mechanism — the intermittent. The many advantages of a faster 5-to-1 movement over the 3-to-1 geneva movement should receive serious thought from designers.

By JOSE M. RUIZ

Fast-Pulldown Intermittent Movements Solve Many Projection Problems

IN REGARD to Mr. J. G. Jackson's letter appearing on page 23 of the September issue of IP, I wish to state that it was not my intention to deny either the originality or the workability of Mr. Jackson's intermittent mechanisms. I still incline to the view, however, that Jackson's oscillating-cam intermittent is too complex. The reason is simple: the ideal mechanism for film transport is one which has the fewest possible parts in motion. The motion-picture projector, and particularly the complete film-transport mechanism, should be simple as well as dependable.

The claw intermittent mechanism has been used for many years to produce intermittent travel of the film in most 8-, 9.5-, and 16-mm. "substandard" projectors. As a matter of fact, claw movements were even used in professional 35-mm. motion-picture projectors in the early days of cinematography. From the days of the Lumiere Cinematographe, the first practical camera-projector, to the present time, the claw intermittent of the classical 3-corner cam-and-shuttle type has been the intermittent device most widely used in amateur and professional substandard cameras and projectors. They are easy to manufacture and are very accurate in pulldown action.

16-mm Geneva Movements

The idea of employing the geneva intermittent mechanism and its variants for substandard projectors is very old, and was always in the minds of many professional and amateur designers. As early as 1916, for example, Thomas Armat employed an interesting variant of the geneva movement for amateur cinematography, his experimental machine being the first substandard projector using an intermittent *sprocket* instead of the usual shuttle, or claw. Of course, the Armat intermittent mechanism handled 17.5-mm. film with the familiar 4 perforations per frame, and hence the 16-tooth sprocket was directly mounted on the 4-position square intermittent star of special design.

The Geneva drive and its variants are used at present in many American and European projectors manufactured with excellent design and operational features. Now, the use of geneva mechanisms for 16-mm. projectors is feasible if the designer bear in mind a few of the fundamental laws of the geometry of geneva drives and the physical limitations of 16-mm film.

The principal handicap of the 4-point star for 16-mm. intermittents is the small diameter and small num-

Why This Article Is Noteworthy

IP HAS LONG advocated intermittents *faster* than the conventional 3-to-1 (90-degree) geneva movement. The advantages of 5-to-1 (60-degree) movements have been pointed out time and again in these pages. Rapid intermittents allow narrower shutter blades for brighter pictures, when maximum screen illumination is desired, or alternative 3-blade shutters for virtually flickerless projection at the highest light levels. We have even presented detailed descriptions of fast-acting intermittents on several occasions, a noteworthy recent example being the oscillating-cam movement designed by J. G. Jackson (IP for February 1955, page 7).

New equipment has literally poured into the theatres since 1950. First 3-D, then CinemaScope and stereophonic sound, now horizontal VistaVision, Todd-AO, and who-knows-what. Changes have been many, and improvements have taken place in many departments of production and projection. *But the sluggish intermittent movement of the theatre projector remains untouched!*

Equipment designers have all but neglected the "heart and soul" of the projector. Why? Frankly, we don't know why! And yet the urgent need for a faster intermittent of suitable acceleration-deceleration characteristics can be met — and soon! To support our seemingly bold contention, we herewith present an enlightening exposition of rapid variants of the familiar geneva movement by a remarkably well-informed authority on the subject, Jose M. Ruiz of Santa Clara, Cuba.

Projector designers may well take note of our author's high praise of the "eccentric-star" geneva-type intermittent, *a movement which may be used even in any present-day theatre projector!* The acceleration characteristics of the eccentric-star movement are all that could be desired; its more rapid deceleration is of no consequence in theatre machines which, after all, are never run in reverse.

Notes on the adaptation of geneva movements to 16-mm. projection are included in Senor Ruiz's informative article.

ber of teeth on the 4-frame 16-mm. sprocket — in this case a diameter of 3/8 inch and only 4 teeth. The heavy stress imposed upon the film by the wrap around the 4-frame 16-mm. sprocket (shown in Fig. 1) results in an obvious mechanical and physical impracticability when such a sprocket is mounted directly on the starwheel shaft.*

Jackson's Movement

The intermittent of Jackson's design is without doubt an original mechanism. After an intensive review of Mr. Jackson's article, the writer believes that such movements are operable for 35-and 16-mm. work. With the latter size of film it is possible to use either an 8-frame 16-mm. sprocket geared down by means of 2 herringbone Nylon gears of constant velocity ratio in 1-to-2 ratio, or an 8-slot geneva star with the 8-frame sprocket mounted directly on the star shaft by taking advantage of the fast-working action of the double-oscillating cam of Jackson's 60-degree pulldown.

One interesting fact about these oscillating intermittents would be the calculation of the forces involved in the several mechanical components in motion and the operational noise level of the mechanism. Three types of forces are involved: rotational, accelerating, and frictional. Intermittent movements which have more than 2 components in motion are mechanisms of great complexity, and the question of accelerating forces must be considered very carefully by the designer.

The immediate reaction to the unsuitability of 4-frame sprockets for 16-mm. purposes is to ask why a larger sprocket may not be used with the geneva star-and-cam mechanism. Why not, for example, use an 8-frame sprocket in conjunction with an 8-point star? The arrangement shown in Fig. 2B is mechanically feasible, but has the drawback that the "intermittent efficiency," or the equivalent of film-pulldown time in terms of the revolution of the cam pin, is increased to 135 degrees (Fig. 2B) as compared with the 90-degree pulldown of the conventional geneva movement used in 35-mm. projectors, and shown in Fig. 2A.

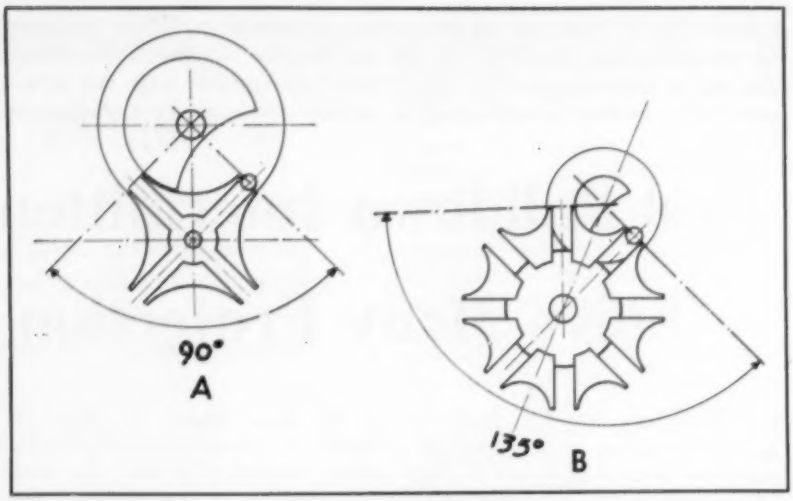

FIG. 2. Comparison is made between a conventional 35-mm geneva movement A and a suggested 8-point star for use with an 8-frame 16-mm sprocket shown at B. A drawback of arrangement B is that pulldown time is increased.

A study of Fig. 2B reveals that the 8-point star takes 3/8 of one revolution of the cam pin to move one frame of film in the gate. According to the geometry of the geneva star, an increase in the number of slots, or stations, results in an increase in the pulldown time in degrees. *This is the chief disadvantage of a geneva drive having more than 4 slots in the starwheel.* There are, however, ingenious mechanical expedients which successfully circumvent the geometric limitations of the conventional geneva mechanism.

Geared-Down Movements

A direct solution to the problem has been effected by the German firm of Eugene Bauer in the Selecton II 16-mm. projectors having sprocket intermittents. The Bauer machine employs a 4-point star geared down by means of two high-precision constant-velocity gears to an 8-frame sprocket in 1-to-2 ratio, as shown in Fig. 3. The star rotates through an angle of 90 degrees while the sprocket turns only 45 degrees. This geneva movement gives rocksteady and quiet operation, but the use of a gear train *interposed between the star and the* sprocket is highly objectionable if the gears have not been produced with sufficiently great precision or do not have a scientifically correct tooth shape.

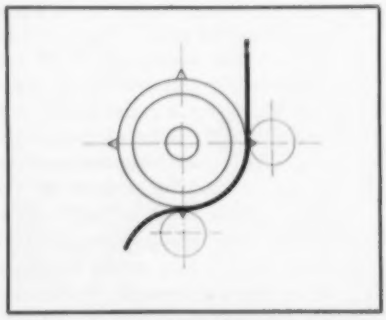

FIG. 1. This drawing shows the 4-frame 16-mm sprocket. The heavy stress imposed on the film when wrapped around this sprocket makes it impractical.

Accelerated Intermittents

The use of an 8-slot geneva star with one or more "accelerator elements" designed to bring the pulldown cycle under 90 degrees, shown in Fig. 4, illustrates the geometric functioning of the off-center accelerator element upon the cam driver.

The 8-point star *A* is actuated by the cam *B*. The pin *C* is shown at the start of the pulldown. The cam shaft has a large disk *D* with a slot *G* in its back face. Into this slot enters pin *C'*, which is mounted on the off-center shaft *F* by means of the disk *E*. It can thus be seen that the constant rotation of the drive-disk *E* will be converted into accelerated and decelerated rotation of the cam *B*, *and the geneva star will be actuated in its pulldown at the highest point of acceleration of the disk D.*

The amount of off-center displace-

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* **EDITOR'S NOTE:—To Correct any misapprehension which might arise from the above discussion of the unsuitability of 4-tooth intermittent sprockets for 16-mm. projectors, we take the opportunity of pointing out that intermittent sprockets of such small diameter were never advocated by J. G. Jackson, inventor of the oscillating-cam movement.**

"I consider, as does Mr. Ruiz," writes Mr. Jackson, "that the 4-tooth (16-mm) sprocket is too small to be practical."

ment of disk *E*, from disk *D*, alters the rapidity of the pull-down shift, hence any speed desired, from the fastest pulldown of 30 degrees to one as slow as 135 degrees, is possible.

The principle of geneva drives employing accelerators in conjunction with an 8-slot star is presently utilized in a few European 16-mm. projectors such as the Duiker and Philips in Holland and the Ideal, the Leitz, and the Hortsman in Germany. And in America Eastman Kodak employs the same principle in the Model 25 projector.

The Kodak machine has an 8-point geneva star and 2 balanced accelerators with the off-center arrangement to effect a pulldown of only 57 degrees. The movement gives rocksteady pictures and is free from operational noise. The alternated position of the accelerators reduces bearing loads and vibrational forces inherent in all high-speed mechanisms where sudden accelerations prevail.

The possibility of changing the pulldown time from the high acceleration of 30 degrees to one as slow as 135 degrees makes the "variable-pulldown" intermittent very useful in television work. Eastman Kodak offers the Model 25 projector for full storage operation with iconoscope television cameras in which the pulldown time may be adjusted to accomodate the TV scanning period.

"Drunk-Cam" Intermittents

Mechanisms of the pin-cross type resembling the old Powers intermittent are sometimes used. Still another type of mechanism for pulling the film intermittently through the projector gate is known as "drunk-cam" type. These make use of cylindrical grooved cams and "pinstar" wheels, as shown in Fig. 5.

This type of intermittent and its variants usually have a 60-degree pulldown time. The Miracle 16-mm. projector has a 6-pin star made of hard alloy cast by a special process and ground to glass-finish surfaces. The cylindrical cam is made of a hard aluminum alloy developed during the second World War. Both pin-star and cam are machined to close tolerances.

This by no means exhausts the list of variants of the familiar geneva intermittent movement. The Holmes Tutor projector employs an interesting one. This machine has an 8-slot star actuated by a "V" edge-disk having an interrupted section to unlock the star during the pulldown cycle. The pulldown action is achieved by a steel wire attached to the cam body; and it works as a "face cam." Pulldown time is approximately 60 degrees.

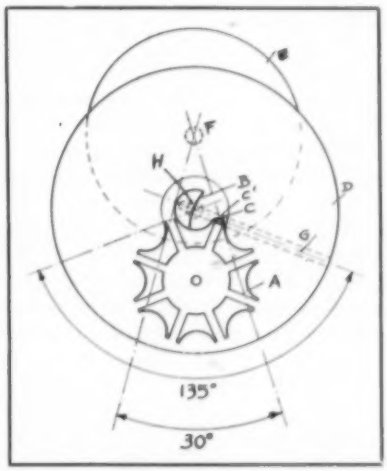


FIG. 4. An 8-slot geneva star with one or more "accelerator elements" designed to bring the pulldown cycle under 90 degrees. Illustrated is the geometric functioning of the off-center accelerator element upon the cam driver.

Another interesting projector intermittent of the drunk-cam type is found in the Model PB-100 manufactured by the General Precision Laboratory. This projector employs a 12-pin star and drunk cam. Framing is accomplished by rotation of the intermittent sprocket *via* an ingenious arrangement of gears and a spring-loading device in the drunk-cam shaft.

Eccentric-Star Movement

The eccentric-star intermittent provides a 60-degree pulldown with the great advantage of having only two mechanical parts in motion. The accompanying drawings demonstrate in a graphic way the curves developed by the working angle of cam rotation and film velocity in the gate.

The curve plotted in Fig. 6 shows the velocity generated in the conventional 4-point, *radial-slot* geneva star. The velocity of the film as the pin enters the slot tangentially is practically zero up to about 8 degrees of cam revolution, and with rapidly increasing acceleration it reaches the maximum pulldown velocity at the top of the curve (half pulldown cycle), or 45 degrees of cam rotation. At this point the velocity of the star is greater than that of the cam. The other half-curve component is the reverse of the first half-cycle. The maximum acceleration changes into decelerate velocity until the star once again reaches rest position. A

(Continued on page 29)

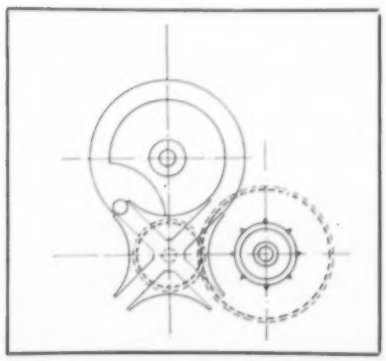


FIG. 3. A commercially practical 16-mm intermittent employing a 4-point star geared down by means of two high-precision constant-velocity gears to an 8-frame sprocket in 1-to-2 ratio.

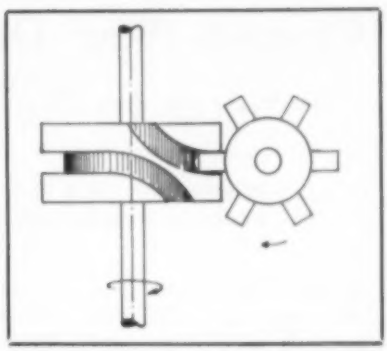


FIG. 5. "Drunk-cam" type of intermittent movement which makes use of cylindrical grooved cams and "pin-star" wheels.

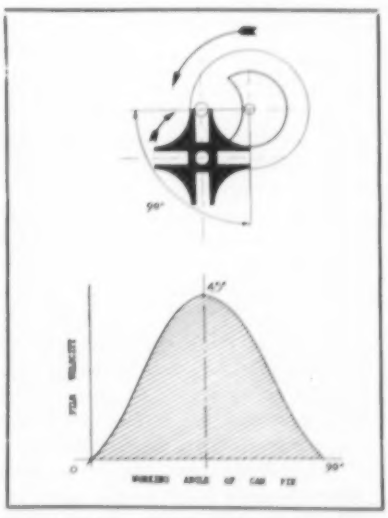


FIG. 6. Curve at bottom shows the velocity generated in the conventional 4-point, radial-slot geneva star illustrated at top.

Cronar, New Du Pont Film Base, Soon to Be in Production

Winter field tests in theatres are scheduled as an additional check before distribution of this film.

THE TIME when "Cronar," Du Pont's new film base, will be regularly used in the manufacture of motion picture release prints is drawing closer. Extensive field tests on this new base, which is a polyester plastic similar to Nylon, have been conducted in theatres scattered throughout the country. The film was found by projectionists to stand up well under hard use, but one objection was brought forth. Some projectionists found that they experienced difficulty in keeping Cronar film in focus.

Further laboratory tests are now being made by Du Pont to determine the exact cause of this problem and eliminate it. Additional field tests will be held this Winter when Cronar-base prints of the film, "Desperate Hours," will be distributed to theatres in several areas. These tests will probably be the final check on Cronar before commercial distribution.

A new Du Pont factory located at Parlin, N.J., will soon begin large-scale production of Cronar film. It has also been announced that the Eastman Kodak Co. has been licensed to manufacture the film base under Du Pont patents.

Thinner Than Acetate

Cronar is different in a variety of ways from the cellulose triacetate base now used almost universally for motion picture release prints. Its principle advantage is that it is tougher than acetate, making it much more resistent to tearing and kinking. Because of its toughness, it can be thinner, allowing as much as 35% more film to be wound on a reel. Cronar base is 4 mils (*a mil is a thousandth of an inch*) thick, compared with the 5.5 mils thickness that is standard for acetate safety film. The cost of shipping film and the amount of storage space required are both reduced.

More significant to the projectionist than shipping cost is the fact that this increased footage per reel will make for fewer changeovers per show. Probably the most important characteristic of Cronar from the projectionist's point of view is its toughness. In laboratory tests using a 6-foot loop of Cronar film, it was found to endure 3,000 runs through a standard 35-mm projector under normal operating conditions with little sign of wear afterwards. A loop of acetate film withstood 1150 runs under the same circumstances.

Both laboratory and field tests were conducted by the Du Pont Co., and the results were described in a paper read by Dr. Deane R. White, of Du Pont, at the Fall convention of the Society of Motion Picture and Television Engineers. The paper was written by Dr. White in conjunction with C. J. Gass, E. Meschter and Wilton R. Holm, all of Du Pont.

Except for one case of equipment failure (the take-up belt broke), reels containing Cronar film were run for more than 300 times in the field tests conducted last Spring without any film breakage whatever, even in the leaders, according to the paper read before the SMPTE. "No perforations broke out, and no repair splices had to be made on the polyester reels," it was said. Leaders of cellulose triacetate film, used for comparison tests in the same theatres, had to be replaced twice or more often before 300 runs had been completed.

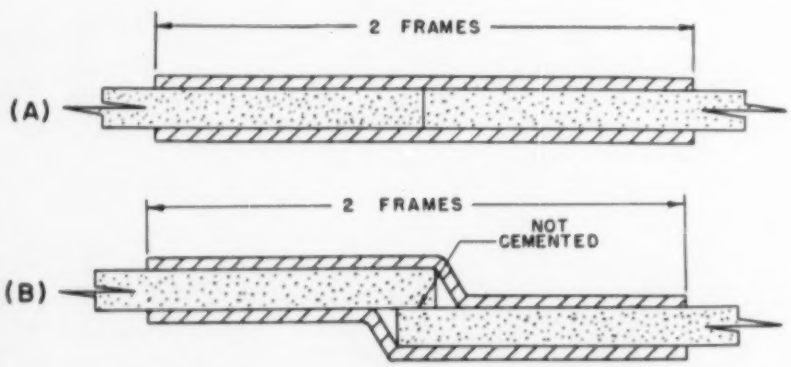
Focus Difficulties

The field tests turned up only one difficulty, it was reported, a tendency of the 4-mil Cronar base to be difficult to focus in some projectors. "Additional high-intensity projection studies are now in progress, and it is expected that evaluation tests in the near future will demonstrate freedom from focus troubles," it was predicted by Dr. White.

Two typical comments from projectionists who helped to test Cronar film in the field follow. Although reported independently and not incorporated in the paper read by Dr. White, these comments are in agreement with his findings.

"This film is very pliable and extremely difficult to break or tear by hand even if folded double," states Jules Margules of the Criterion Theatre, New York City. "Since it is slightly thinner than ordinary stock, you can put about 1,350 feet on a 1,000-foot reel. There is a certain resiliency to the film so that even the pull on the sprocket holes when the motor is started does not undercut or break the film. At the end of the test run, the leaders were not broken nor in need of any patches. We find it to be a big step in the advancement of our industry."

The focus problem was noted by Ted Pylet, of the Hawaii Theatre in Hollywood. "I ran the test film for one 12-hour shift and found it to have a tendency to go in-and-out of focus," he said. "This I believe was due to



This is how extremely thin, adhesive-coated tape is used in splicing where Cronar film is involved. (A) is a butt splice and (B) a lap splice. Since no cementing or welding of the two ends to be joined takes place, Cronar can be joined to itself or to any other film base despite the difference in the chemical nature of the ends to be joined. The "Mylar" tape used for the splicing was also developed by Du Pont. This tape with its adhesive coating is only 1.5 mils, or 1.5 thousandths of an inch, thick.

Request for Information

To the Editor of IP:

Many of the articles in your magazine were of great help to me when CinemaScope was installed in my theatre, so I would like to suggest additional articles that I think would interest me and also other projectionists. I would very much like to read an article about what the theatre of the future will be like. Will they settle on CinemaScope, on a 2 to 1 aspect-ratio picture like VistaVision, or just what?

Have they learned any more about the film cements for the new Cronar base? Will they develop an all-purpose cement to join Cronar to acetate and nitrate bases? I would enjoy an article on that.

Also I agree very heartily with your Monthly Chat in the August issue. We both know that there are bad projectionists just the same as there are bad ministers, bankers, common laborers, etc., but the great majority are sincere, even though they are always getting cussed for a lot of things that are beyond their control.

At the same time, I am a little confused by the number of complaints you hear these days about too much sound volume and bad focus. I have pretty good luck on controlling volume and have good focus on the screen most of the time.

We have 45-ampere Motiograph lamps, Standard Simplex projector heads, and Simplex optical sound. Our screen is 12' x 23½' and we have a 100-foot throw. We use a 1.75/1 aperture and 4" *f*:2 lenses for regular shows and a 2.33/1 aperture and Super Panatar anamorphics for CinemaScope. This is why I am confused: Does our setup come closer to having a good-looking screen (in focus, etc.) than a screen three times as large?

People tell me that they like our single-track optical sound better than stereophonic because they find the stereophonic too loud.

ALBERT POWERS

Ashland, Kansas

EDITOR'S COMMENT: As to the request made in the first part of Mr. Powers' letter — we'll do our best. At least some of the information he requested should be appearing in IP within the next few months.

As to the description of the equipment in Mr. Powers' theatre, and the size of his screen — all we can say is that, in a lot of ways, he has it made. A great deal of present focusing trouble results from the necessity of filling a big, wide screen with fast, short-focal-length lenses. These lenses are as good as they can be and they accomplish their purpose, but by their optical nature, they have little depth of focus. Movement of the film away from the film plane, such as when it buckles from heat, will register on the screen.

The preference of many customers for the sound in Mr. Powers' theatre can probably be attributed partly to the fact that other theatres in the area try to advertise their stereosound systems by cracking people's eardrums.

File of IP for Sale

To the Editor of IP:

I am a member of the craft now associated with the Bell Telephone system, but as projection and all that goes with it will always remain my first love I shall remain a permanent subscriber eagerly awaiting each issue.

I have on hand a good stock of well preserved back issues, and if you can find room in your columns to publish a notice, some interested brother might wish to take advantage of the wonderful information they contain.

The issues are complete from October 1944 to August 1955 with the exception of the following: Sept., 1945; May, 1947; Oct., 1951; July, 1952; Sept., 1953. I will sell the entire stock for five dollars plus the postage or will send c.o.d. to any interested brother.

Formerly with Fox West Coast Theatres, I worked out of Local 762, San Luis Obispo, Calif., and worked for some time with W. Young Louis, affectionately known as "Cholly," about whom you published a very fine article and picture a few years ago.

C. F. ORMOND

195 San Francisco Blvd.
San Anselmo, Calif.

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the fact that the film was not heavy enough to withstand the heat from our carbon arc lamps."

Splicing Procedures

Introduction of Cronar will bring about a change in splicing procedures. An article in the March 1955 issue of IP described in detail a universal splicing method for Cronar and other film bases which employs a perforated tape of "Mylar" polyester film coated with pressure-sensitive adhesive. Mylar tape is chemically similar to Cronar but much thinner. This tape is a truly universal splicing medium because it will make splices without regard to the chemical nature of the two film ends joined.

Alternative techniques for making splices needed in laboratories and exchanges, where use of the tape might not be adapted to processing methods, are in the final stages of development and will be introduced prior to full commercialization of Cronar, it was stated in the paper read before the SMPTE convention. "The chemical inertness of polyester base limits the choice of solvents that can be used to secure a bond of the type commonly made with cellulose ester films," it was stated. "In fact the best splices made with equipment originally designed for cement splicing of films have been made with a cement formulation in which ordinary solvent action appears to play little part."

So far as the projectionist is concerned, splicing problems rising out of the use of Cronar film can be solved through use of thin transparent adhesive tape applied to both sides of the film with the aid of an appropriate splicing apparatus. By lapping a small portion of one end of the film to be spliced over the other and applying the tape, a strong and durable splice can be made. Butt splices can also be made with this tape.

Since no chemical bond between the spliced ends is required—they are held together by the tape and not cemented or welded together—Cronar may be joined to acetate as well as to itself, even though the two bases are of different chemical nature.

Drive-in Growth Continues

A recent report by National Theater Supply on potential theatre construction and equipment sales lays heavy stress on the drive-in field. The report lists about 5000 drive-ins in actual operation today, 600 more in the planning stage, with still another 400 possibilities, particularly in the industrially booming South where milder climate permits year-round operation.

It was noted that the cost of certain major equipment is considerably more for the drive-in than for the indoor theatre. This is especially true as regards projection and sound setups. It is estimated that the total cost of a sound system is several times greater for an outdoor than for an indoor theater of the same capacity. Outdoor screens with supporting towers may cost 20 times as much as an indoor screen. Other drive-in requirements are higher capacity lamps and generators. Film cooling equipment is usually needed.

SO REAL...

On the wide, wide screen make-believe is real, as time stands still. Cost is great for films like this. But so are the rewards—as producer after producer solves problems in production, processing and projection . . . makes use of new technics developed in co-operation with the Eastman Technical Service for Motion Picture Film. Branches at strategic centers. Inquiries invited.

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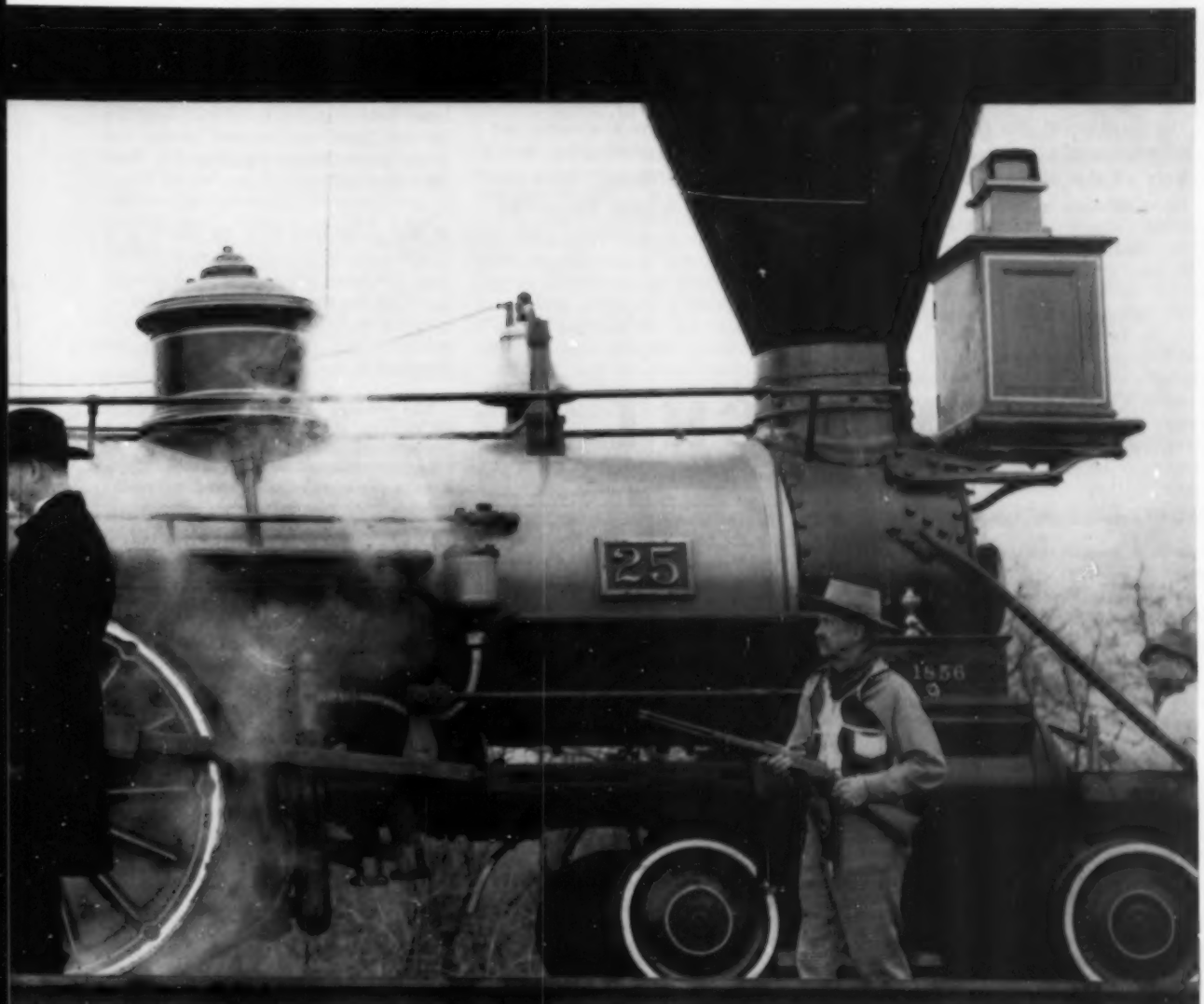


the audience ducked with every shot

East Coast Division
342 Madison Avenue
New York 17, N.Y.

Midwest Division
137 North Wabash Avenue
Chicago 2, Illinois

West Coast Division
6706 Santa Monica Blvd.
Hollywood 38, California

The function of this department is to provide a forum for the exchange of news and views relative to individual and group activities by members of the organized projectionist craft and its affiliates. Contributions relative to technical and social phases of craft activity are invited.

In The SPOTLIGHT

A STEP forward in labor management relations signalized the recent pact between the IATSE and the major West Coast studios which, among other benefits, provides for a five-day week for 15,000 studio workers. The new collective bargaining agreement establishing the five-day week becomes effective January 30, 1956 and will run through January 30, 1959.

Under the five-day schedule, weekly employes will receive the same pay they have received for six days, with reduced schedules of total hours which can be worked without overtime pay. For example, the 60-hour schedules will be reduced to 54 hours in five days; 54-hour schedules to 48.6 hours; and 48-hour schedules to 43.2 hours.

Time-and-a-half will be paid for studio work on Saturdays for the period from January 26, 1956 to January 29, 1957, with double-time thereafter for the balance of the contract. Daily workers are to receive a 25c per hour increase effective immediately. Both daily and weekly scales will be hiked 2½% on January 30, 1958.

Pension, Welfare Payments

The contract also provides for increased pension plan and health and welfare fund payments. In addition, there is a provision for three-weeks annual vacations for workers after 12 years with one employer.

IA President Richard F. Walsh and Charles Boren, vice-president in charge of industrial relations for the Association of Motion Picture Producers, headed the negotiating committee. Assisting Walsh were the following: George Flaherty and John Ford, IA representatives, and Carl Cooper, second IA vice-president. Hollywood Locals were represented by James Crowe, 44; William Holbrook, 80; W. E. Higgins, 165; Herbert Aller, 659; Alan Jackson, 683; Thomas A. Carman, 695; Wm. L. Edwards, 705; Albert K. Erickson, 727; R. W. Nichols, 728; Ralph W. Peckham, 729; John A. Ward, 767; John W. Lehners, 776; Paul E. O'Bryant, 789; Zeal Fairbanks, 790 and 847; Dillard C. Thomason, 816; Lloyd Ritchie, 818; Miss Kay Lenard, 854.

• Eddie Miller, IA representative and business representative for Local 279, Houston, Texas, recently played host to his daughter, former movie and radio star Nan Grey, and her husband, singer Frankie Laine, when they stopped off at Houston for a visit before returning to their home in Beverly Hills, Calif.

• Los Angeles Local 150 won the first round in its fight against the management of the Paradise Theatre when Superior Judge Walter R. Evans ruled in the Local's favor in denying the exhibitor's request for an anti-picketing injunction and for $115,000 damages. The theatre had been picketed since last April when the two Local 150 projectionists were replaced by a non-union man. The exhibitor's charge of "featherbedding" was not sustained and the court held that the Local's demand for the continued employment of the two union projectionists constituted a "lawful objective."

• We quote here from an article in a recent issue of *The Showman*, a widely-read exhibitor publication in Australia, in which the writer deplores the lack of cooperation in that country between the exhibitor and the projectionist in the purchase of projection equipment.

> The average exhibitor is not a technical person, therefore the advice of the projectionist should be sought, since he (the projectionist) is or should be up-to-date in the knowledge of the latest equipment. When the rounds of the supply houses are made, *both* exhibitor and projectionist should make them *together*.
>
> In large circuits top executives seek advice from their own technicians on the various makes and types of equipment before purchasing. With smaller outfits, however, the tendency seems to be "If I can buy film right, I should be able to buy equipment right. It is no concern of the projectionist."
>
> It *is* the concern of the projectionist. He has to maintain and run the equipment, so it becomes very much his concern. Cooperation in this matter is vitally necessary for both parties.

Fortunately, these sentiments do not necessarily apply to the average exhibitor in this country today. The bitter and costly lessons learned during the past few years with the advent of the new processes when Mr. Exhibitor found himself confronted by a bewildering and conflicting array of projection equipment, has taught him to be a bit more wary in his purchases. He has learned the wisdom of consulting with his projectionist and getting his opinions on the various types of equipment *before* making any purchases. Since the projectionist has to use the equipment, the final choice usually reflects his preference.

IA FOURSOME AGAIN WINS HIGHLY-PRIZED GOLF TROPHY

Repeating last year's victory, members of Toronto Local 173 won the coveted N. A. Taylor trophy in the recent Ontario Picture Pioneers annual golf tournament. Shown here are the members of the victorious team, left to right: Frank Cox, George Georges, Fred Cross, and Andrew Pura.

• The suits and countersuits between Denver Local 230 and the management of the Evans Drive-In there were brought to a head recently when the District Court issued a temporary injunction against the management enjoining it against any violence to the Local's pickets. Controversy between these two factions began December, 1954, when the Local was notified that the services of the union projectionists were no longer needed as the theatre manager would take over the operation of the machines.

Unable to come to terms with the exhibitor, Local 230 charged breach of contract and established a picket line. Although the exhibitor requested a "temporary restraining order" against the Local's picket line and filed suit for damages, the Court upheld the Local's right to picket the theatre and advertise to the public the existence of a labor dispute.

The damage suit against the Local is still pending, but in view of the fact that the exhibitor was unable to produce evidence in court showing a loss of business as compared with the previous year's business, it is believed that the suit will eventually be dropped. Meanwhile, picketing continues and Local 230 officials are confident that the Evans Drive-In will eventually come into the fold.

25 Years Ago—November 1930

• The IA General Executive Board convened at the Bradford Hotel, Boston, Mass., in conjunction with the AFL convention the week beginning October 6. . . . IA Locals warned to be on the lookout for industrial traveling units using sound motion picture equipment with non-union projectionists. These units were used chiefly for advertising and promotional purposes. . . . O. M. Jacobson, Local 175, Tacoma, Wash., was appointed IA representative by President Canavan. . . . A jurisdictional dispute between N. Y. Studio Mechanic's Local 52 and N. Y. Cameramen's Local 644 was settled by the Board in favor of the Studio Mechanic's Local. . . . The Projectionists Sound Institute at Easton, Penna., was investigated by the National Better Business Bureau, Inc. of New York. In its report, the NBBB revealed a number of inconsistent promises and guarantees offered to prospective students by the Institute.

• The IA has chartered the new Film Exchange Employes Local No. B-63 in Houston, Texas. The Local has an enrollment of 40 members. Similar film exchange IA Locals are located in 32 other cities in the United States and in four cities in Canada. E. J. Miller, IA representative in Houston, will install the charter in the near future.

• Firm in its determination to gain for their members benefits and improved working conditions that prevail in other Local Unions throughout the Alliance, the officials of Detroit Local 199 have been negotiating a new contract with Detroit exhibitors to replace the contract that expired August first last. Pending negotiations, the members have been working without a contract.

Among the benefits sought by the Local are a six-day work week with the existing weekly pay scale; time-and-a-half for overtime pay, and a pension plan which will provide pensions of $75 per month to those members who have worked 20 years when they retire at the age of 65.

National statistics show that wages in the Detroit area are the highest in the country and it is the Local's contention that it is high time its members shared in some of these gains.

Should it become impossible to reach an agreement, Gilbert E. Light, president of the Local, is quoted in the trade press as stating that the matter would be taken before the Michigan State Mediation Board. He further said that the IA has given the Local authorization to take a strike vote, and if the Board fails to resolve the matter, definite steps would be taken in the direction of a strike.

• The hobbies of projectionists are many and varied, ranging in scope from participation in ski tournaments to golf matches. Many have become so proficient in their respective hobbies that they have won championships, as witness the Georgas brothers of Toronto Local 173, who for the past 15 years have consistently walked off with top honors in important ski meets in Canada. The latest top-ranking sports amateur member of the IA to come to our attention is Benno Kusenburger, member of Local 407, San Antonio, Tex. In the recent Brackenridge Park (Tex.) pro-amateur golf tournament, Kusenburger was a member of one of the teams that deadlocked for first place, shooting 63, 8 under par; he also topped the 45 player field.

Benno Kusenberger, recent winner of the pro-amateur golf tournament at Brackenridge Park, Texas.

• New York Local 306 recently concluded negotiations for new contracts with the Loew and RKO circuits and the major Broadway houses calling for a 10% increase. Broken down, the 10% increase covers a wage boost of 7% retroactive to June first last, and an additional 3% increase in the employer's contribution to the Local's welfare fund. The contracts are for four years, from June 1955 to June 1959, and carry the proviso that they may be re-opened at the end of the third year for wage adjustments upwards should business warrant it.

A separate pact was signed with the management of the Rivoli Theatre where the Todd-AO feature, "Oklahoma," is presently being shown. The agreement calls for 11 projectionists. Ten of the projectionists receive $130 per week, and the 11th, a maintenance man, receives $160 per week. The feature, which runs for two hours, is presented twice daily, one show in the afternoon and one in the evening. Projectionists cannot work more than four shows in any given week. The Local contends that the extra manpower and higher pay scale is warranted by the "endless supervision" and special handling of the widescreen equipment.

Herman Gelber, president, headed the Local's negotiating committee. Assisting him were Al Kunze, vice-president; Ernest Lang, secretary; Steve D'Inzillo, NYC business representative; Harry Garfman, Brooklyn business representative; L. Schwartz, financial-secretary, and Abe Kessler, treasurer.

Kodak Sales Reach New High

Sales and earnings of Eastman Kodak Co. for the first three quarters of 1955 were higher than in any corresponding period in the company's history, according to a report issued by Albert Chapman, president.

Consolidated sales of the company's U.S. establishments for the first three quarters, ending Sept. 4, 1955, amounted to $487,284,358, up 13% over $430,846,992 for the corresponding period in 1954. This is 11% above the previous high set in the first three quarters of 1953. Net earnings after taxes for the 1955 three quarters were $57,982,467, up 23% over the $46,958,693 reported in the same period a year ago. Both years broke all previous records.

Chapman said that the company expects business will continue its upward trend during the final quarter of 1955.

Growth of Closed-Circuit Tv Is Aided by Portable Projectors

Efficient TNT organization promotes wide use of projection-Tv in theatres and hotels by using mobile equipment and actively seeking business.

By NORMAN WASSERMAN

THE RECENT closed-circuit telecast of the Marciano-Moore heavyweight championship fight was presented at 133 theatres, drive-ins, auditoriums, fair grounds, and veterans hospitals throughout the nation. A record audience of more than 350,000 viewed the show in 92 different cities, pouring a total of $1,240,000 into the box offices. The Bell Telephone Co., responsible for the line-laying and cable transmission, said that it was the largest and most complicated one-shot network ever used.

Behind this operation was TNT — Theatre Network Television — with Nate Halpern as president. TNT is pushing to broaden the market for this young and growing method of communication and entertainment. Since 1951 TNT has presented 14 championship fights, the previous top gross being $500,000 for the Marciano-Charles fight in September, 1954.

Business Networks

In between fight telecasts and other special events, TNT concentrates on large scale business communications. Through a subsidiary division called Tele-Sessions, TNT enables organizations to conduct meetings and conventions without having to transport a huge audience to one central spot. By making use of the flexible nationwide coaxial cable network of the Telephone Co., Tele-Sessions adapts its services to the unique needs of each individual client.

Not long ago, the Sun Oil Co. introduced a new gasoline to some 14,000 dealers over a network spread out through thirty cities. A TNT Tele-Session also tied together 52 hotel luncheons into an elaborate coast-to-coast celebration of the 50-millionth car manufactured by General Motors. President Eisenhower was televised by closed-circuit from the White House in Washington directly to an invited audience at the Dearborn Plant of the Ford Motor Co.

Tele-Sessions' closed-circuit business communications are designed for organizations of all sizes, says Martin Poll, executive producer of TNT. Networks can be set up nationally, regionally or locally, with receiving locations ranging from one to one hundred. Prospective clients can consult with a trained staff at TNT regarding any aspect of programming and production.

The major problem confronting TNT for a long time was that of mobile projection equipment. Since comparatively few theaters and auditoriums owned their own permanently installed theatre Tv equipment, a large supply of sturdy mobile units was needed for a flexible national operation.

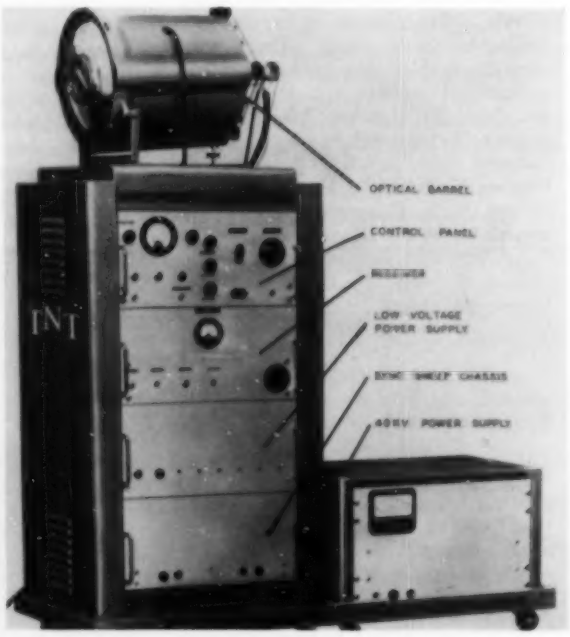
In November 1954 TNT solved this problem by purchasing a half million dollars worth of General Precision Laboratories' newly developed mobile projectors. The total number of units came to 57, 30 of which were the lightweight (700 lbs.) PB 610 model, a completely self-contained projection system used chiefly in hotels and auditoriums. The remaining 27 units were all PB 600 models, weighing 2000 lbs. and consisting of projector, control rack, and power supply, designed especially for larger ballrooms and theatres. Since their purchase they have been used for 16 shows totaling 586 "air hours" without any equipment failure.

Storage, Installation

When not in use, the equipment is stored in supply depots maintained by TNT in major cities throughout the country. When a show is scheduled, the Bell Telephone Co. engineers the job of connecting cables and loops to the various outlets. The actual installation of the projector equipment is performed by the RCA Service Co.

Where the show is a paid admission attraction rather than a business meeting, such as was the Marciano-Moore bout, the projectors are rented to the theatre or other outlet having no permanent equipment of its own. In the case of Tele-Sessions, the equipment is included as part of the overall package production.

The PB 610 is actually a smaller



PB 610 mobile Tv projector manufactured by General Precision Laboratory. Designed chiefly for smaller theatres and auditoriums, the unit is completely self-contained and weighs 700 lbs.

version of the PB 600 model and is expressly intended for smaller audiences. Picture size varies with the throw distance and can be made large enough to be viewed comfortably by 700 persons. The PB 610 works equally well for off-the-air signals and closed-circuit inputs. The picture tube contained in the optical barrel is a five-inch projection kinescope, the image being projected by the usual Schmidt optical system. The ultor voltage for the tube is provided by a regulated high-volltage supply.

The control console is mounted on wheels and contains a control panel, television receiver, sync-sweep chassis, and low and high voltage power supplies. The optical barrel is located at the top of the console. Sweep failure protection circuits prevent destruction of the projection kinescope phosphor in the event the electron beam is deflected or interrupted.

Console Controls

A breakdown of controls and indicators of the various parts of the console is as follows:

CONTROL PANEL: The ON-OFF switch regulates power to the rack console. The high voltage ON-OFF switch regulates power to the high voltage power supply when the ON-OFF switch is closed. Both these switches have pilot lamp indicators. There is also a high voltage pilot lamp indicating when high voltage is applied to projection kinescope, as well as a sweep failure pilot lamp that lights to indicate removal of high voltage due to sweep failure. There is a program selector switch controlling the selection of input signals using three different positions:

(A:) Video input from phone coaxial line.

(B:) RF input from antenna.

(C:) Auxiliary input for phone coaxial line or test signal.

The audio gain attenuates audio for all positions of the program selector switch; in position "B" the audio gain works in conjunction with the audio volume control on the receiver chassis. Then there are the various picture controls for contrasts, focus, vertical hold, and horizontal hold. A control panel meter indicates the kinescope beam current.

RECEIVER: The video control varies the gain of the video amplifier in the receiver chassis. The automatic gain control sets the threshold point of the automatic gain control bias voltage applied to the RF and IF amplifiers. The audio volume control regulates the gain of the audio output stage. There is a channel selector switch that permits the selection of any commercial television station operating on channels 2 through 13. A fine tuning adjustment provides a vernier adjustment of the RF oscillator in the receiver, while a receiving meter indicates when correct tuning of the RF oscillator is obtained.

SYNC-SWEEP CHASSIS: This part of the rack console contains the raster or picture information controls. The vertical and horizontal centering controls center the raster in both directions. The height control regulates expansion and compression in the vertical direction, predominantly affecting the lower half of the raster; while the vertical linearity control performs the same function, but predominantly affecting the upper half of the raster. The horizontal linearity controls 1 and 2 control the linearity at the beginning and end of the horizontal sawtooth waveform (left and right side of picture respectively).

LOW VOLTAGE POWER SUPPLY: This chassis contains no variable controls. Two fuses and pilot lamps are mounted on the front panel. A 5-ampere, 3AG type fuse protects the power transformer primary while a ½-ampere, 3AG type protects the DC circuits.

HIGH VOLTAGE SUPPLY: The high voltage ON-OFF switch controls application of power to high voltage supply. The high voltage control sets the high voltage output level, and the high voltage meter indicates the high voltage output level in kilovolts.

All-Purpose Ace Splicer Announced

An unusually versatile film splicer, designed to handle any gauge motion picture film from 16-to 70-mm and also to splice Du Pont's new Cronar film base as well as acetate, has been developed by Irving Merkur, member of New York Local 306, and head of the Ace Electric Mfg. Co. An added feature of this splicer is that no magnetic material is used in its construction. It cannot injure magnetic sound tracks.

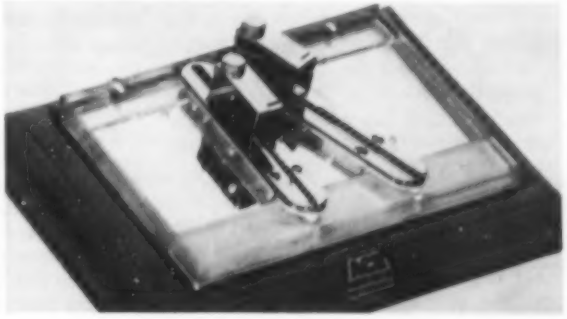
Designed in a new way, this splicer is constructed of aluminum, bronze, and Lucite. Non-magnetic stainless steel cutting blades are the only ferrous metal components. Instead of cement, Du Pont's extremely thin Mylar tape is used as the splicing agent.

The best way to understand how the new splicer works is to examine the accompanying photograph. Register pins are set in the aluminum base plate which can be seen through the transparent Lucite cover plate. The pins are set in such a manner that any type of film can be registered. When the plastic cover is clamped tight, one of the cutter handles appearing at top of the illustration is drawn across the film to prepare the ends for the splice.

The cutter handle placed at right angles to the back of the splicer would be used for splicing motion picture film. The cutter that is offset toward the diagonal is used for splicing magnetic sound tape which this splicer is also designed to join. Sound tape is usually spliced diagonally so that the entire splice does not pass the sound gap at the same moment. This prevents noise.

Mylar Tape Used

As stated above, the splicing agent used is not cement but Mylar tape perforated to conform with motion picture film sprocket holes. Pre-cut pieces of this tape are removed from a paper backing by the projectionist and applied to the film when it is registered in the splicer. The adhesive coating of the tape adheres to the film on pressure and provides an extremely strong splice. More information about this splicing method can be found in an article on Cronar film that appears elsewhere in this issue.



Newly designed Ace splicer is non-magnetic and will handle any size film from 16- to 70-mm. It will also splice Cronar as well as acetate film.

Opinions About Todd-AO

The premiere of the film, "Oklahoma," drew some adverse criticism because the engineers had not fully perfected a new laboratory printing technique before the opening.

FILM critics and technical experts who last month attended the New York premiere of the first Todd-AO production, "Oklahoma," registered a mixed reaction. All considered the picture to be a big, cheerful and attractive show which would keep box-office cash registers ringing, but there was considerable criticism of the screen image delivered by the first Todd-AO print exhibited to the public.

What puzzled some observers was that the picture shown at the Rivoli Theatre had a great many white scratches and distorted horizontal lines. Another print shown privately on the West Coast sometime earlier was unscratched and nobody had reported distortion.

The difference between the New York showing and the earlier test in Hollywood is attributed to the failure of the American Optical Co. to produce a good distortion-correcting print in time for the opening. This printing process was described in the October issue of IP.

The AO factory in Southbridge, Mass., was badly damaged by flood in August and could not bring the final model of its newly designed printer into use quickly enough. The opening date at the Rivoli could not be postponed. The print used for the premiere, according to Todd-AO president Henry Woodbridge, was a trial product of a crude early version of the printer. It was never meant for exhibition to the public.

New Projection Setup

Since the opening, projection methods at the Rivoli have been changed. Instead of using the theatre's regular projection room in the rear of the theatre, which has a very steep angle of throw, an additional booth, built into the front of the mezzanine, was put into use.

This booth has little or no projection angle, so the corrective print was not required. A contact print, similar to the one shown earlier in Hollywood, was used, and a much better picture resulted.

The corrective printing process, developed by Dr. O'Brien of the American Optical Co., has not really been tested publicly. This will have to wait until the American Optical Co. delivers a perfected product from their new printer, a print with built-in distortions designed to counterbalance the distortion inherent in projecting a picture on a deeply-curved screen from a sharp angle.

The following excerpts from reviews in the New York papers are typical of press comments on "Oklahoma" and the Todd-AO projection process:

The Times, *Bosley Crowther*

"At long last, 'Oklahoma!' . . . has been brought to the motion picture screen in a production that magnifies and strengthens all the charm that it had upon the stage . . . Inevitably, the question which leaps to every mind is whether the essential magnificence and gusto of the original has been retained in the sometime fatal operation of transfer to the screen. And then the question follows whether the mechanics of Todd-AO which is being inauguarted with this picture, are appropriate to articulate this show . . . To the first question, there is only one answer: . . . a full-bodied 'Oklahoma!' has been brought forth in this film to match in vitality, eloquence and melody any musical this reviewer has ever seen . . . To the question of whether the dimensions and the mechanism of Todd-AO are appropriate to the material, one can only say that the serious expanse of screen is fetching, but the system has disconcerting flaws."

Tribune, *William K. Zinsser*

". . . Fortunately the movie is true to the original . . . and Todd-AO takes the moviegoer out of his cramped theater seat and onto the rolling farmland . . . The effect is not completely three-dimensional, but there is a good illusion of depth . . . The figures on the screen are tremendous, and the close-ups are so sharp in detail that the texture of skin and clothing, the sheen of a girl's hair, are almost real enough to touch. The colors are vivid, and the movie has many striking landscapes . . . But Todd-AO is best in closeups."

World Telegram, *Alton Cook*

" 'Oklahoma' seems likely to become as much of a box office milestone in movies as it was in stage annals. The glamour of the title and music should keep the picture in the newly refurbished Rivoli for months . . . News about Todd-AO is less cheery . . . Level settings run downhill toward the edge of the screen, an affect that is particularly disconcerting in dance numbers."

National Circuit to Sponsor Cinemiracle Process

An aggressive expansion by the National Theatres circuit into the new "roadshow" type of film presentation, emphasizing use of complicated projection techniques, was recently announced in Los Angeles by Elmer Rhoden, president.

Rhoden stated that National will make an expenditure of $5,000,000 in perfecting its new Cinemiracle process and bringing the first product to the screen. Subject to government approval, the National circuit will sponsor production of Cinemiracle features in addition to converting some of its theatres for their exhibition.

The Cinemiracle system uses three projectors as does the now-familiar Cinerama system and would obtain much the same kind of effect on the screen. It is believed to have practical advantages over the latter system because the three film strips are projected from a single central projection room rather than from three different locations in a theatre. This saves seating space and makes installation easier. The first feature to be filmed in the Cinemiracle process will be produced by Louis de Rochemont, producer of the current "Cinerama Holiday."

Rhoden also reported that National is expanding its present theatre holdings, citing the recent acquisition of the Joe Laurence circuit or six indoor theatres and one drive-in in the Salt Lake City area. The Department of Justice approved the acquisition of the theatres under the terms of the consent judgment aimed at ending monopolistic practices in the motion picture field.

National will also acquire, subject to government approval, a drive-in at Las Vegas, Nev., and has bought five-acre sites at Van Nuys, Calif. and at another Western location for the construction of what is described as a "new type or modern motion picture theatre."

OBITUARIES

A. C. (SLIM) MAYES, 54, member of Local 612, Abilene, Texas, died last month at his home following a heart attack. He worked in the projection room of the Key City Drive-In Theatre in that city. A native Texan, Mayes began his show business career back in 1920 when he joined a "rep" show as a clarinetist. About 1927 he played with the John Philip Sousa band but not finding a bandsman's life to his liking, he left that organization after a winter tour and returned to his first love—vaudeville. He traveled to Columbia, Mo. in 1935 where for a number of years he played the clarinet and violin in vaudeville theatres. He returned to Abilene in 1952 where he remained until his death. Survivors include his wife, four children, and his father.

LAWRENCE J. SHAFER, 67, charter member and former officer of Local 160, Cleveland, Ohio, died recently after a short illness. He was a member of the Local for the past 45 years, and at the time of death held the office of trustee. Shafer was an ardent golfer and was widely known as a photographer of golf stars and of golf courses. He was an active Mason and held membership in Concordia Lodge, Hillman Chapter, Holyrood Commandery, Lake Erie Consistory, Al Sirat Grotto, and Al Koran Shrine. Survivors are his wife, son, and two grandchildren.

HARRY AKERLY, 69, veteran member of Pittsburgh Local 171, died recently. He was the father-in-law of Phil D'Ivernois, head of the sound department for Stanley Warner in Pittsburgh.

MARTIN VALLAPADIERNA and FRITZ GRUN, members of San Antonio Local 407, died within one week of each other. Villapadierna, a member of the Local for 39 years, was 63 years old when he died on September 27 following a lengthy illness. Grun, a member since 1945, died on October 2.

CHARLES CLARK, 67, member of Local 386, Columbus, Ohio, since 1938, succumbed to a heart attack on September 24. For the past 15 years he worked as projectionist for the Miles circuit. He is survived by a son, daughter, and three grandchildren.

16-mm Shutter Conversion Kit

The Victor Animatograph Corp. of Davenport, Iowa, has announced a shutter conversion kit for its 16-mm projectors produced since 1942. The light increase is estimated to be 38% over the three-interruption type shutter used on previous models of Victor projectors. The new Victor Mark II two-interruption shutter breaks the light beam 48 times per second compared to the old three-interruption shutter which breaks the beam 72 times per second at sound film speed.

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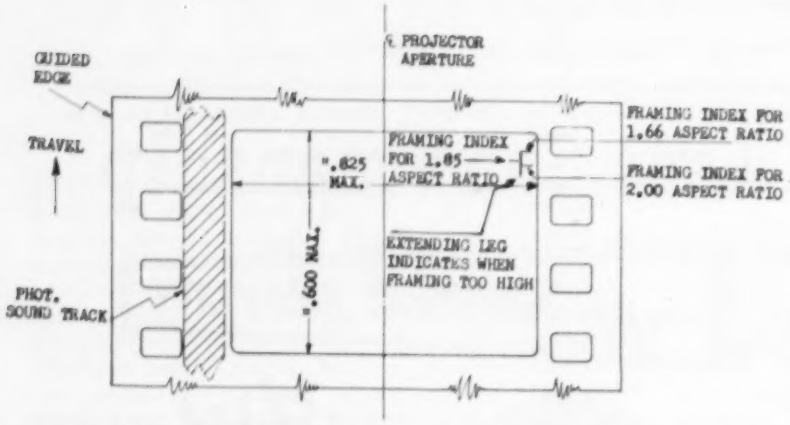
Framing Index for Wide-Screen Pictures



New framing index for non-anamorphic wide screen pictures may be seen at upper right hand corner of frame in diagram.

A FRAMING index to cue projectionists for correct framing of unsqueezed wide-screen pictures projected through a cropped aperture has been developed by Paramount Pictures and recommended to all studios by the Motion Picture Research Council. Lack of such a system of markings has been responsible for the heads or feet of a screen image being cut off unnecessarily. This happens even if the picture has been correctly photographed for a wide-screen ratio, and the projector aperture is of the proper size.

In the procedure described here, the framing index marks appear at the head end of each 2,000-foot reel of release print. Shown in the upper right-hand corner of the accompanying diagram, this framing index appears twice, in the same manner as the changeover cues. Its first appearance is 12 feet after the start of the reel for 12 consecutive frames, and again 8 feet after the first appearance for 14 consecutive frames.

How to Read Index

When the upper horizontal line extending to the right is framed at the top of the screen masking, the picture will be correctly framed for an aspect ratio of 1.66/1 or 1.75/1. When the horizontal line extending to the left is framed to the top screen masking, the picture will be correctly framed for an aspect ratio of 1.85/1. When the lower horizontal line extending to the right is framed to the top screen masking, the picture will be properly framed for an aspect ratio of 2/1.

If the picture is being projected in the old aspect ratio of 1.33/1, the picture should be framed as in the past, namely the top of the picture image should be framed just above the top screen masking.

In using the framing index, the projectionist will make the changeover exactly as in the past. He then has time to glance at the picture, check the arc and make sure that everything is performing correctly. After this check, he again looks out the port and sees the first framing index. If the picture is still not correctly framed for the aspect ratio being used, he changes the framing position the desired amount and watches for the second framing index. This verifies the framing or indicates whether further adjustment should be made.

All of the index marks for any one picture are located in the same relative position on the frame. In practice it is then only necessary for the projectionist to make his framing correction at the start of the first and second reels. The framing should be correct on all subsequent reels as long as the framing control has not been changed.

The position of the framing marks may vary slightly from picture to picture, depending upon the manner of shooting and the head room allowed in the original photography. The position of these index marks will, of course, be established by the respective studios to comply with their practice.

The timing intervals were established after a series of tests with projectionists who had gained familiarity with this system. We believe it allows adequate time without unnecessary waiting at the port.

The index marks are scribed on the negative and will appear on all prints. The little leg extending down from the 2/1 position was placed there so that the projectionist would see a signal even when his framing was too high. This is then the signal for him to frame down.

Aluminum Plate Screen for Drive-Ins

A SCREEN fabricated of extruded aluminum panels was recently developed by the Motion Picture Research Council for use in drive-ins requiring greater picture brightness and broader horizontal light distribution. The screen is being installed in a number of large new drive-ins throughout the country.

With the advent of the wide screen and because many outdoor theatres already had extremely wide horizontal viewing angles, it was felt by the Research Council that a special type screen had to be devised which would permit all locations within the viewing area to see a brighter picture. What was needed then was a directional screen with a fairly high brightness gain and a distribution of about 45 degrees on each side of center.

Fluting Controls Light

After a series of trials and errors, it was decided to combine vertical aluminum fluting with proper surface diffusion. The final light distribution in horizontal and vertical directions is a function of the two dependent variables, flute shape and surface diffusion. The surface diffusion primarily determines the gain and vertical distribution, while the fluting is primarily responsible for the horizontal light distribution.

The required surface diffusion previously provided by a specific paint formulation was duplicated by direct physical and chemical processing of the aluminum surface. This resulted in much experimentation, for many critical factors, optical and otherwise, developed.

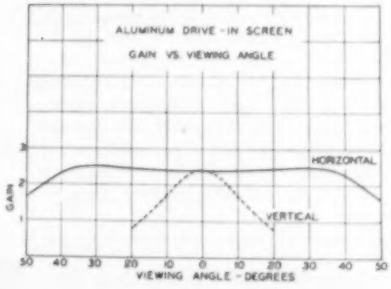


Chart showing the horizontal and vertical brightness distribution of the Research Council screen.

The accompanying chart shows the horizontal and vertical brightness dis-

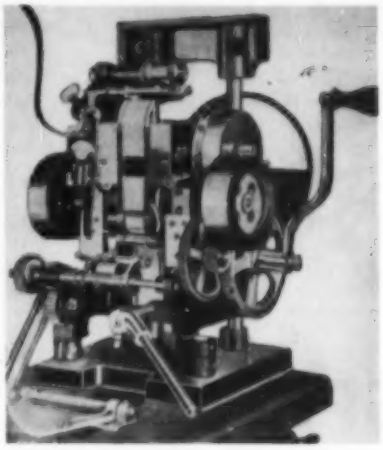
(Continued on page 32)

Ray Brian — Motion Picture Historian

WE PRESENT here another portion of Ray Brian's unique collection of data on the history of motion picture equipment. The following listing is the fifth installment of a series and brings the total number of projectors listed so far to 114.

Ray Brian is a member of Local 434, Peoria, Illinois. He is constantly in search of new additions for his already extensive collection of over 350 items. With the exception of those listings marked here with an asterisk, he has photographs, and in many instances, actual possession of the equipment named. IP readers who may have additional information are urged to contact Ray Brian through this publication.

Following is the listing for this month:



Lubin's "Marvel"—1912 model.

GARDINER—made in Columbus, Ohio.
G and B—made by Gaumont British Co.
GAUMONT—Leon Gaumont, Paris, 1902.
GRAND—made by Bell & Howell Co., about 1930.
GRAPHOSCOPE—Charles Jenkins, 1916.
GRANDEUR—International Proj. Co., 70-mm, 1928.
GRAY—Robert Gray, glass plate projector, 1895.*
GREENE—Wm. Friese-Greene, 1912.
HAHN—made in Germany, about 1910.
HALL—made about 1920.*
HALLBERG—made about 1922.
HARVARD—made about 1900.*
H and B—made by Hamilton & Baker in Australia, since 1922.
HELIOS—Helios Projector Co., Chicago, Ill., about 1926.*
HIGGINSON—made in England, 1921.
HOLMAN—Arthur J. Holman, 1920.
HORTSON—made in France, 16-mm and 35-mm combination, 1952.
HYPNOSCOPE—made about 1900.*
ICA—Carl Zeiss, Germany, 1909.
IKON—Carl Zeiss, Germany, 1930.
IKONOGRAPH—John Leggren, New York City.*
IMPERATOR—made in Germany by Ernemann.
IMPERIAL—made by English Pathe Co., 1910.
IMPERIAL—made in England by Imperial Sound Co., 1935.
INDOMITABLE—Tyler Apparatus Co., 1914.
INTERNATIONAL—made in Japan, Ernemann design.
INVICTA—Noakes & Norman, London, 1897.
INVICTA—made in England by Kalee Co., 1930.

Electronic Lens Tester

RCA has announced the development of an electronic instrument which will enable optical scientists to evaluate and grade the performance quality of lenses in objective mathematical terms. Until now, a spokesman said, lens sharpness, contrast and gradation has been determined solely by visual tests.

Hilux Lens Price Reduced

Projection Optics Company is now offering its Hilux 264 and Superlite Lenses at a special combined price of $475 per pair.

A New Method of Film Splicing That Solves All Problems

- It makes a strong splice on standard acetate film.
- It is non-magnetic and cannot injure CinemaScope soundtracks.
- It will splice the new Du Pont polyester film and also join Cronar to acetate film.
- It will splice any width of film from 16-mm to 70-mm.

Of a completely new and simple design, the versatile "Clear Vision" splicer will solve any splicing problem that comes up in the projection room. Instead of liquid cement, extremely strong "Mylar" tape, only 1.5 thousandths of an inch thick, is used as the splicing agent. This tape is available in rolls or in pre-cut portions for either 35-mm or 16-mm film. The sturdy splicer is completely non-magnetic because it is constructed of aluminum and lucite and has non-magnetic stainless steel cutting blades. Designer and manufacturer is the Ace Electric Mfg. Co., producer of many high-quality products for the projection room.

Ace Clear Vision Splicer

For more details write: Camera Equipment Co., 1600 Broadway, New York 19, N. Y.

What Do You Know About Carbons?

The fourth of a series of questions and answers which explain the unique nature of carbon and describe how the substance is utilized so as to provide the brightest of all artificial light sources. Data provided by National Carbon Company.

Determining Screen "Brightness"

If the light intensity in foot-candles and the reflecting power of the screen are known, the "brightness" of the screen in "*foot-lamberts*" can be determined by multiplying the foot-candle values by the reflecting power of the screen.

For a screen of known reflecting power the light intensity in foot-candles necessary to obtain a given brightness in foot-lamberts is determined by dividing the foot-lambert value desired by the reflecting power of the screen.

Since a motion picture screen is ordinarily brightest at the center, the specification of brightness of a particular screen should include values not only for the center but for the sides and perhaps the corners as well.

ASA Viewing Standard

In order to ensure a sufficient screen brightness for proper viewing conditions the American Standards Association (Standard Z22.39-1944) has specified:

"The brightness in the center of the screen for viewing 35-mm motion pictures shall be 10 $^{+4}_{-1}$ foot-lamberts when the projector is running with no film in the gate."

In other words, the brightness in the center of the screen should be within the range of 9 to 14 foot-lamberts. For a perfectly diffusing screen of 75% reflecting power, the incident light to meet these conditions should be within the range of from 12 to 18.7 foot-candles.

Which Carbon Produces Light?

The light used in projection all comes from the incandescent crater face of the *positive carbon*, the brightness of which is determined by its temperature.

Since carbon vaporizes at a temperature of about 3,670°C, further increase in current beyond the value which produces this temperature does not increase the crater temperature and brightness but increases only the area of the crater up to the full cross section of the carbon without spindle.

If the current is increased the carbon consumption is increased proportionately. The phenomenon is the same as that of the three-minute egg. You can turn up the gas and boil the water away more rapidly, but the temperature remains the same in the pan and the three-minute egg is still a three-minute egg. In practical operation the upper limit of crater brilliancy in the low intensity D.C. arc is approximately 17,500 candles per sq. cm.

Differences Between High And Low Intensity Arcs

In the high intensity arc the core of the positive carbon is relatively larger than in the low intensity arc and contains rare earth materials which become highly luminescent under the action of the electron bombardment in the arc stream.

The current density in the positive carbon is also increased to values which may exceed 1,500 amperes per square inch. At this high current density the material of the core is vaporized more rapidly than that of the outer carbon shell until a deep, cup-like crater is formed in the face of the carbon.

Within this crater vapors of carbon and core materials are excited to a very high temperature and radiating

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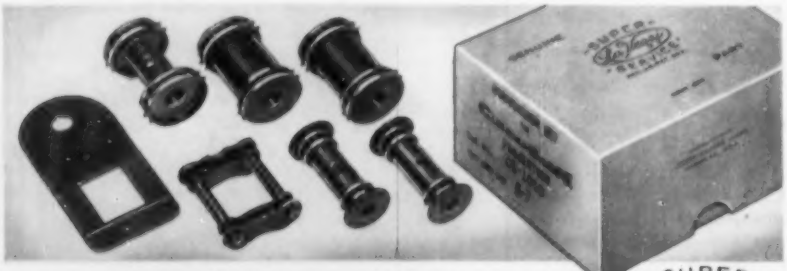
The new wide screen presentations demand rock steady projection which for years exhibitors have been expecting and getting by using LaVezzi sprockets. In addition, the clean burr-free teeth are easier on the film—an important factor with the narrow perforations of the four stripe magnetic film. LaVezzi sprockets are properly engineered to resist wear—and are hardened for that extra margin of usable life. For better projection and peace of mind get LaVezzi and be sure!



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efficiency. The effect of this action is to produce a brightness within the crater cup several times that possible at the positive crater of the low intensity carbon arc.

Clear-Screen Image Requirements

A clear screen image requires a screen brightness conforming to the A.S.A. Standard Z22.39-1944 of 10 $^{+4}_{-1}$ foot-lamberts with the projector running and no film in the gates. Low intensity projection lamps will not provide this amount of light on the screens of many neighborhood houses.

Effect of Light on Color Film

The audience sees on the motion picture screen only those colors that are present in the projection light and which remain after others are absorbed by the color film. If certain colors are absent from the light, no trick in the film can put them on the screen; the film can only absorb or transmit light. It cannot create colors in any other way.

On the other hand, excess of certain colors in the light source likewise distorts the natural hues of color features. High intensity carbon arc projection assures an evenly balanced light with all colors present in essentially equal intensity.

[TO BE CONTINUED]

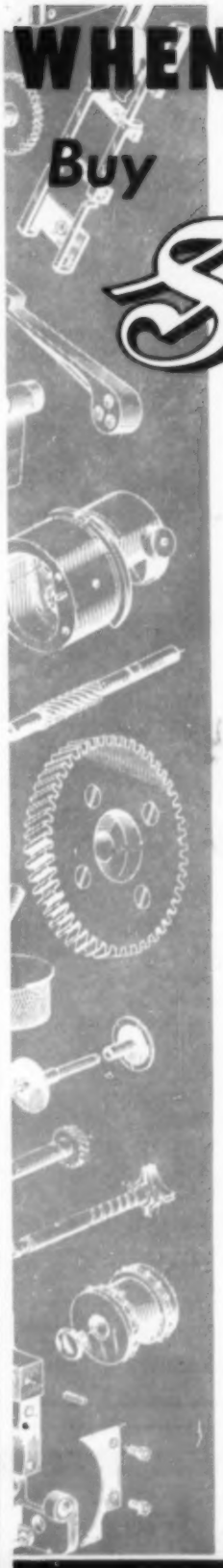
FASTER INTERMITTENTS

(Continued from page 15)

symmetrical curve is thus developed in the conventional geneva movement.

Figure 7 shows the plotted curve for the eccentric-star intermittent with slanting, or non-radial, slots. The curve plotted in Fig. 7 reveals at a glance the extended acceleration of pulldown in the eccentric-star movement during the first half of the cycle. The following half pulldown cycle shows a rapid deceleration from the top of the curve (45 degrees) to rest position (90 degrees). The curve generated is accordingly *asymmetrical.* This is the main advantage of the eccentric-star intermittent movement.

It is desirable, of course, to accelerate the film slowly from zero position to maximum acceleration of the film in order that gate pad tension can be overcome at the start of the pulldown. The eccentric star also has the advantage of a quick return to rest position, bringing the film to rest by the time that the master



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blade of the occulting shutter opens to let light pass through the film.

The eccentric-star intermittent no doubt has a few disadvantages, such as necessity of operating the machine in only one direction of rotation at all times. Another disadvantage of the eccentric star is the proximity of the slots to the curved edges of the star. This defect can be corrected with a larger, flanged star, and amounts to little more than a matter of experimental work.

The writer feels that the eccentric-star intermittent movement is far superior to any other intermittent mechanism of the geneva type in approaching the optimum 60-degree pulldown. An outstanding advantage of the 60-degree pulldown is that it makes possible the use of a 3-blade shutter with 60-degree openings to give a 72-cycle cutoff frequency with 50 per cent light transmission.

Geneva movements for 16-mm. projectors are far superior to claw intermittents for many reasons. A particular advantage of geneva-type mechanisms is the placement of star and cam in an oil-filled housing for quiet operation and a long life of satisfactory service. Isolation of mechanical shocks generated in these mechanisms by large forces of acceleration may be accomplished by using two separate, but interlocked, synchronous motors, one for the intermittent and the other for the continuous film-drive and sound-head.

Useful data for the calculation of

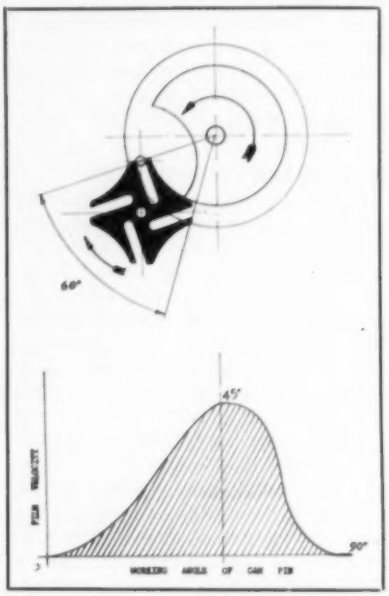
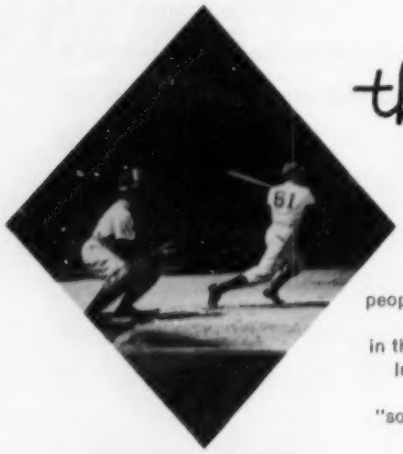


FIG. 7. An eccentric-star intermittent with slanting, or non-radial, slots. The asymmetrical curve plots the velocity of this movement during pulldown.

these high-speed intermittent movements are scattered through a large mass of technical literature. Among the many articles that provide good examples of the problems encountered in this interesting field of motion picture engineering are "Mechanisms for Intermittent Motion" by Otto Lichtwitz in *Machine Design* (December 1951, January, February, and March 1952); "The Application of Pure Mathematics to the Solution of Geneva Ratios" by R. W. Jones, *SMPTE Journal* (July 1946); "Design Factors in 35-mm Intermittent Mechanisms" by Arthur Hayek, *Journal of the SMPTE* (November 1947), and "Fast-Cycling Intermittent for 16-mm. Film" by Warren R. Isom, *Journal of the SMPTE* (January 1954).



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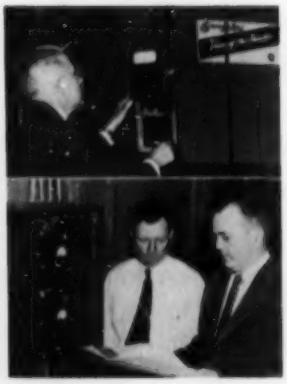

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55-MM C'SCOPE NEGATIVE

(Continued from page 12)

studio. And what they actually saw was a screening of a 35-mm reduction print from the 55-mm negative. They were so enthused with the wonderful quality of this new medium, Halpin says, that they immediately decided to discontinue the protective photography by the 35-mm camera.

Await New Cameras

"As more of the new cameras and lenses are produced," he said, "more 20th Century-Fox productions will be scheduled for shooting in the new 55-mm medium. However, we shall continue to shoot CinemaScope productions with our regular 35-mm cameras.

"Nor will our swing to production on 55-mm film affect the more than 30,000 CinemaScope installations in theatres throughout the world. On the contrary, use of the new camera and larger negative will result in a great increase in the pictorial quality of our productions, when the 55-mm negative is reduced to 35-mm for projection in conventional CinemaScope theatres.

"While some 'showcase' theatres will be equipped with 55-mm projectors and custom-tailored screens, plus additional sound equipment to utilize a seven-track stereophonic sound system, this will be for the purpose of obtaining the ultimate in theatre presentation. The screen aspect ratio will remain unchanged. 20th Century-Fox regards the present ratio of 2.55-to-1 as eminently satisfactory for viewing, audience participation and story-telling purposes.

Elaborate Sound System

"The new seven-track stereophonic sound system will utilize five horns placed in pre-determined positions behind the screen. Of the remaining two tracks, one will serve as a control track and the other a special sound speaker."

Whereas present CinemaScope equipment has improved the viewing of pictures in theatres, the new lenses and wide film that will be used in exhibiting films in the roadshow houses, Halprin said, will produce another great improvement in definition and depth.

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ALUMINUM SCREENS

(Continued from page 26)

tribution of the Research Council screen. The horizontal distribution is adequate to 45 degrees. Fortunately, the required vertical angle for drive-in theatres is very small. A good 90% of the viewing positions are within plus-or-minus 5 degrees of the direction of peak reflection. However, for best results, the screen should be tilted to the proper angle to place the peak of the vertical distribution curve near the center of the viewing area.

Aluminum extrusions were chosen for surface fabrication because of their durability and easy installation. It was found that anodized aluminum withstands the effects of the weather better than anything else. For installation, a flange is provided along one edge of the extrusion panel for attachment to the screen tower.

Washing Important

The ultimate life of the finished surface depends, to a large degree, upon the washing schedule. Kept free of chemical deposits by frequent washing, the surface will last indefinitely, it is claimed.

In tests conducted by the Research Council, their screen was compared with a flat-surfaced white screen. The Council's light meter indicated that the fluted aluminum screen returns much more light in addition to affording wider horizontal distribution. The screen is manufactured under license from the Research Council by Manco-Vision, of Butler, Wis., and priced at $1.85 per square foot.

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ARCLAMP RECTIFIERS

(Continued from page 10)

the AC supplied by the power company, fluctuations in line voltage and power factor can come through to the arc-lamps and show up on the screen.

Imbalance in the rectifying efficiencies of the two half-wave components of a rectifier will effect projection quality. Beat-frequency flicker results from this imbalance. Two diode tubes or two stack units may not have exactly equal current-outputs, particularly when old tubes or stacks are operated in combination with new ones. Even 3-phase rectifiers can produce this kind of flicker when the tube or stack circuits are electrically unbalanced.

The operation of rectifiers is simple, necessitating the observance of only a few precautions. Because a separate rectifier is required for each projection lamp (2 rectifiers for a 2-projector installation), there arises the question of turning each rectifier off when not in use or leaving both sets on for the duration of the show. In general, mercury-vapor tube rectifiers are left on (filaments lighted) throughout the show, for this type of rectifier needs at least 3 minutes warmup time before it is ready to deliver current to the arc-lamp.

Tube Rectifiers

Tube rectifiers having tungar diodes may be left on continuously or shut down when not in use *according to the manufacturer's recommendations.* In cases where the arclamp table switch is discontinued (left "on" and

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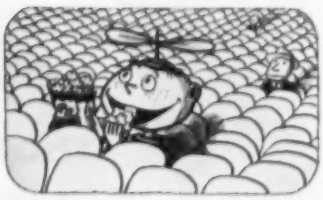

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the handle removed to prevent control of the arc circuit at this point), the circuit is "made" and "broken" by means of the large radial-switch knob on the rectifier itself. This knob also permits the projectionist to select the proper current (amperes) for the carbon trim he is using. Tungar-tube rectifiers having this method of DC-circuit control are, of course, turned off completely to extinguish the arc and turned on again when the time arrives for relighting the lamp. Such rectifiers should be installed as close to the projectors as possible—preferably beneath each lamphouse.

Tungar-tube rectifiers are also available which allow the DC arc circuit to be made and broken by the usual method, that is, with the table switch. This is true of all the rectifiers made for 3-D projection. Both rectifiers are turned on just before starting the show and are left on until the conclusion of the performance. The filaments of the diodes are thus kept lighted continuously, and not turned on and off for each reel.

Tungar filaments do not sag appreciably nor deteriorate by being burned continuously. Tube life is not shortened, as all the "wear and tear" occurs only when current is actually being rectified. There is also no danger of overheating the rectifier transformers when the filaments are kept lighted: the amount of current consumed by the filaments is very small in comparison to the full-load current consumed by the arclamps. There may be a separate small filament transformer in each rectifier, or else a few additional turns of wire on the secondary winding of the main transformer furnish the filament current.

There is little reason to fear that breaking the DC circuit by means of the arclamp table switch will develop a surge of current, due to transformer reactance, that will cause flashover and damage to tungar rectifying tubes. Mercury-vapor tubes, on the other hand, are apt to flash over on slight provocation; but the use of a large filter condenser connected in shunt with the DC output leads effectively "damps" such surges in all types of rectifier.

It is essential to bear in mind that the filament voltage of tungar-tube rectifiers should remain constant, *and at full value*, even when arc amperage is changed. Most rectifiers of this type, in fact, are designed to supply full rated filament voltage at all times regardless of the prevailing plate current. *No perceptible dimming of the diode filaments should occur either when the arc is struck or when arc current (amperes) is varied to suit different trims of carbons.*

The primary windings of most rectifier transformers are provided with several taps to compensate for line voltage which is consistently higher or lower than normal. Normal voltages are 115 and 230 volts, but these can vary from 110 to 120 volts in the first case, and from 220 to 240 volts in the second.

Injury from Voltage Drop

Strange as it may seem, tungar tubes are injured by *undervolting* the filaments. A few projectionists, knowing that the life of an ordinary incandescent bulb may be greatly prolonged

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by reducing the voltage at which it is burned, have mistakenly believed that tungar diodes may be similarly preserved. The opposite is true. Destructive positive-ion bombardment of the filament increases whenever filament voltage is lowered, the impedance of the plate load (resistance of the projection arc) remaining unchanged.

It often happens that reduction of tungar filament voltage results in erratic DC output: in all cases continued operation under these conditions produces deterioration of all tubes in the rectifier accompanied by the development of marked differences in the outputs of the 2, 4, or 6 tubes of the set. The picture on the screen then suffers from flicker and loss of brightness, and the arc-feed control may become unmanageable.

Never reduce tungar-tube filament voltage as a means of reducing arc current! Never close the lamp table switch and attempt to strike the arc unless the tungar filaments are burning at full voltage! To ignore these rules may result in destruction of the tubes. Damage can be prevented by making sure that the filaments are burning at FULL RATED VOLTAGE before plate current (DC) is taken from a tungar-tube rectifier!

When 3-phase rectifiers are used, ripple in the DC output which is sufficiently low in frequency to make the screen illumination flicker may be traced to differences in the outputs of the different diodes. Tungar tubes are most easily checked by substituting new tubes for old or suspected ones. Should output voltage drop and flicker develop during a show, a whole new set of bulbs should be put into service, the ones taken out checked later to find the defective ones. A minimum of flicker is good evidence that the outputs of the tubes are nearly equal, although voltmeter tests of the individual tubes constitute the most accurate indication of performance.

No Preheating Required

Unlike tube outfits, junction-type rectifiers require no preheating, but are tuned on only when needed. In practice, the transformer primaries of nearly all 3-phase stack rectifiers are left connected permanently to the AC power line. Current drain is negligible until rectified power is consumed by the arclamps.

The best insurance for proper operation of all stack rectifiers is good ventilation and the avoidance of overloads. The safety of a rectifier depends upon the ventilating fan — an item which should be inspected frequently. Rectifying stacks, whether they be copper oxide, sulfide or selenium, can be completely destroyed through heat in the event of fan failure. Continued overloads generate heat, and should therefore be avoided. The life of junction-type rectifiers is considerably lengthened by installation in a cool, dry location.

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Editor: JAMES MORRIS, 19 West 44 Street, New York 36, N. Y.

Managing Editor: R. A. ENTRACHT, 19 West 44 Street, New York 36, N. Y.

Business Manager: R. A. ENTRACHT, 19 West 44 Street, New York 36, N. Y.

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R. A. ENTRACHT, Business Manager

Sworn to and subscribed before me this 6th day of October, 1955.

(Seal) ANNE CORRIGAN

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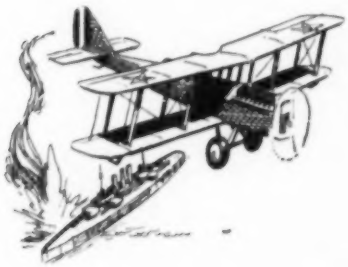

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